SCIENCE

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POST-GRADUATE STUDY IN APPLIED CHEMISTRY

THE subject assigned to me in this discussion seems to have been somewhat mixed. I have been asked to discuss:

1. To what extent is post-graduate training recognized or desired by employers of chemists?

2. What should be the attitude of technical interests toward post-graduate work?

3. What should be the attitude of technical institutions toward post-graduate study?

It matters little how the subject of our discussion is stated, it really becomes, What shall be the training or education of young men whose life work shall be the applications of chemistry, or physics, or both, in the industries? It is a question which the experience of a century at least has scarcely solved. The elements which enter into the answer are too varied, the results to be attained too manifold, the conditions available too perplexing, the personal equation too persistent. Shall the training be confined to the storage of the facts and laws of chemistry and physics in the minds and memories of the young students, trusting to the exigencies which may arise to find their application, and that when the exigencies do arise the facts and laws will be brought forth and be wisely applied? Or shall we first cause storage of facts, principles and laws, and afterwards offer training in the methods whereby these shall be applied and employed in the solution of the problems likely to arise in the industries and to demand treatment with satisfactory results?

Whatever may be said, the latter is what employers expect and demand. The questions which arise must be answered promptly and accurately. The amount of knowledge a man may have acquired and may possess is little appreciated unless it can be applied usefully and effectively. Complaint is not uncommon that young men from the technical schools are over-educated, overtrained; educated above and beyond the positions they must occupy and the work they have to do. While this is unfortunate in form of statement, it nevertheless expresses a fact. Many young men are profoundly educated in theories and laws and at the same time acquire little or no appreciation of the practical value of these theories and laws, even in the advancement of the science to which they relate, and certainly not in the solution of the problems of the industries and the arts of life. There is therefore, whether recognized or not, a demand for something beyond the regular course of study of the university or the technical school. Something beyond the mere cramming with facts and the academic training, to the exclusion of the systematic utilization of knowledge in the promotion of knowledge. Here then is the problem propounded to the educator for solution: How shall young men be educated and trained to meet the demands likely to be presented to them by the chemical industries? In the chemical industries it is natural that a profound knowledge of chemical laws should be required, but in addition to this there must be provided a sound knowledge of such laws of physics as may be necessary to the physical application of chemical laws. In the undergraduate school, first the laws of chemical action and the properties of matter, theoretical and descriptive chemistry, the methods of chemical analysis, qualitative and quantitative, must be taught, and it is well known that one of the first steps in laboratory instruction in these methods is an introduction to the forms of apparatus to be employed in the practise of experiment and analysis. Then comes the application of the laws of chemistry and of the properties of matter to the methods of operation to be used. Now since manufacturing or industrial chemistry is really analytical chemistry in a large way, similar lines of instruction and training must apply in preparation for the industries. If acquaintance with the beaker, the casserole, the filter, the evaporating dish, the distilling apparatus, must be provided in the analytical and research laboratory; if here must be taught the sources and mode of application of heat; transfer of liquids, separation of vapors, liquids and solids; so all these processes made in a small way in the laboratories must be made large in the works. Operations made in a large way must be studied, and the means for effecting them made familiar. The operation of the chemist in the laboratory must become the operation of the engineer in the works. The industries demand that the men who shall control shall have some of that capacity known as engineering, shall know something of the materials and methods of engineering, of the larger apparatus to be employed and its management, and ability to apply the laws of physics in the larger operations of the works. Chemistry and engineering must, therefore, be combined in some measure at least, in the training of the men who will become most successful in meeting the demands of the "technical interests," and whether this is recognized generally or not, it is certainly desired by employers of educated chemists.

But the common complaint of the institutions and their teachers is, that the customary four years allotted to the undergraduate course is too brief for all

that is demanded and required. Here, then, is the problem to be solved: What shall be provided in the undergraduate course or school, and shall post-graduate study and training be provided and carried on under the direction and management of the educational institution, or shall the training, which might be provided by post-graduate study, be deferred and be supplied by actual practise in the works? How, and by whom, shall this very important question be answered? The demand of the present, and of the immediate future, is for men who are able to work independently, to take care of the problems arising, and work them out to successful issue, with profitable result. Directors in the industries and employers have little time, energy or freedom from detail, to devote to the training of young men in fundamental principles. Yet experience can be had only in practise, and this must be paid for in the time, energy and material apparently wasted by young men in the earlier periods of their life work.

But the question still persists. Could the young man working under intelligent direction in the systematic application of the principles he has been taught save time? Will the work of one, two or three years under intelligent and patient training of competent teachers save time of the young man and his employers and relieve both of embarrassment, loss and disappointment?

The laudation of the German chemical industry has extended to all nations, and is probably justified. In some of the most successful branches of the German chemical industry the practise is to take into the works only men who have served as *Privatdocent* in university or technical schools, and to become *Privatdocent* the candidate must generally have taken a course in post-graduate work in investigation and in the solution of problems; work leading to the doctor's degree. First, a training for systematic applied work, then experience in teaching. The value of the latter in the preparation of young men for life work is, I believe, too little recognized. It is certainly true that one of the most excellent means of securing a thorough and fundamental knowledge of a subject is found in an effort to impart such knowledge to others.

I have said elsewhere that an important adjunct to the successful application of knowledge is a trained imagination. Not an imagination "like the baseless fabric of a vision," nor "such stuff as dreams are made on," but an imagination based upon knowledge which furnishes a vision of what may be accomplished and suggests means for accomplishment.

So it seems to me that the proper function of the undergraduate school is to communicate knowledge of facts and methods and that the function of the post-graduate school is to furnish training in the application of knowledge to the solution of problems, to the training of the imagination, and thus to meet the demands which the industries, consciously or not, are making.

A most useful beginning in such work has been made in the laboratories for research in industrial chemistry lately established in some of the leading technical institutions. Here the subjects for research, the applications of knowledge, are not of an abstract but of a concrete character, and provide training in work which may produce results immediately useful in the arts of life. Here the problems arising in the industries in every-day work are solved by students, under direction of men who have themselves been trained in the solution of such problems. By such work the imagination is stimulated and at the same time trained and directed in proper channels; habits of application es-

tablished which must be fruitful later on. The designers of these laboratories, and the authorities who have ordered their organization and establishment, as well as the industries which have patronized and encouraged them, all deserve the highest praise. It is a step in the right direction, and one which must be taken in other educational institutions, if the proper and most effective training of young men for the industries is to be secured.

What then should be the attitude of the industries to post-graduate work? I answer unhesitatingly—*favorable.* What should be the attitude of the technical institutions to post-graduate work? I answer without hesitation, *favorable.* Post-graduate work should be earnestly encouraged from both sides, from the educational and from the industrial, and particularly from the latter. It has been fully recognized in the German institutions by providing in the technical schools courses leading to the degree of "doctor of engineering," and in the universities by the establishment of similar courses and providing for the same degrees. In all educational institutions the attainment of the degree of doctor—a degree not lightly appreciated nor glibly assumed in Germany—involves work of investigation leading to results, work devoted to the application of knowledge and the solution of problems. The industries in Germany are wise in choosing for their employees and directors those who have passed through the office of *Privatdocent* and have had, therefore, experience in the training and management of men. That men may become successful without this very extended and profound training is manifest in this country, and is due largely to the men themselves. But even such men would be better equipped for their work by the training provided by the undergraduate and post-graduate schools and, though frequently compelled by their necessities to enter upon their life work without it, they would save much labor and loss of time to have had it. Many of those who, even with limited training in the schools, have been reasonably successful in the industries, and in their life work in this country, have a right to speak feelingly and affirmatively upon this point.

May young men be overtrained? Surely—in the laboratories and in the class-room, as in the gymnasium and on the athletic field; and they may be weakened, from a practical standpoint, by their training. Yet even these are often carried by their enthusiasm to eminent success. "Fools rush in where angels fear to tread," applies equally well in the world of science and industry as elsewhere, and the struggle to get out after the rush in has produced some of the best results the world has seen, though the influence and the method may not always have been recognized or acknowledged. Each one who has had experience may furnish evidence of this fact. Effort to correct error of one's own making often leads to splendid results. "Necessity is the mother of invention," and the needs of a man in deep trouble make him devise means which otherwise remain dormant and without utilization. Yet errors should be avoided, and the more thorough training should lead to this.

Will the institutions meet this demand for better trained men? Will the new courses necessary to it be established? Of this there can scarcely be a doubt. The institutions are looking for the sign and will respond to it when it is plain. But what of the industries? Will the leaders make the sign prominent and clear? Will they do their share? Do they know what their share is? And do they appreciate their responsibility?

First, the institutions must know what is needed and the knowledge can be acquired only by close relations with the industries. Teachers should have ready access to the industries and their work for themselves and their students. Problems should be submitted for the research laboratories and needed means and materials provided. Such cooperation must certainly lead to important progress, not only in the industries, but in the related sciences, and progress under such circumstances is inevitable. May the influences which control have free course, and be not only justified but glorified.

WM. MCMURTRIE

THE PROGRAM OF THE INTERNATIONAL COMMISSION ON THE TEACHING OF MATHEMATICS[1]

"IF we could first know where we are and whither we are tending, we could better judge what to do and how to do it." These words of Lincoln, like the words of many another genius, adapt themselves to divers situations. This statement epitomizes what the International Commission on the Teaching of Mathematics is to do. The first purpose of this body is to investigate the actual state of the teaching of mathematics in the various countries, and the second purpose is to discover the tendencies of the changes effected during the last two decades. Both of these investigations are to be made with a view to determining "what to do and how to do it." In the language of the central committee the aim of the commission is to suggest those general principles which should guide the teacher rather than to provide programs which should be adapted at the same time to the schools of all countries.

To Professor David Eugene Smith, of Columbia University, belongs the credit of having first suggested the formation of such a commission in the French mathematical journal, *L'Enseignement Mathematique,* in 1905 and again at the International Congress of Mathematicians at Rome in April, 1908. This congress authorized a committee consisting of Professor Felix Klein, Göttingen, Germany; Professor Sir George Greenhill, London, and Profesor H. Fehr, Geneva, Switzerland, to form an international commission. Those countries which have been represented at certainly two of the international congresses of mathematicians, with an average of at least two members, are entitled to representation on the active membership of the commission, while other countries are invited to be represented by associate members. The national delegations are urged to affiliate with themselves national subcommissions, comprising representatives of the various stages of the teaching of mathematics in the general schools and in the technical and professional schools.

General direction is lodged in the original committee of three, Klein, Greenhill and Fehr. The official organ is *L'Enseignement Mathematique,* and the official languages are English, French, German and Italian.

The whole field of mathematical instruction, from the earliest primary work to the higher mathematics of the universities, is to be included in the investigation. A large place will be given to applied mathematics for technical and professional schools.

The work of the commission will be based upon the reports of the delegations, which are to be made out with the aid of the national subcommissions in conformity with the general plan fixed by the central committee of three. In the first part of these reports will be given a view of the actual scheme of studies, the corresponding examinations, the methods of teaching and the preparation of the teaching body. In the second part will be presented the actual tendencies of the instruction.

The aim of the mathematical instruction in the different types of schools—primary, secondary, trade schools, normal schools and teachers' colleges, and colleges and universities—will be discussed. Should the aim of the instruction be the development of the mathematical faculties, or logical reasoning, or

[1] The complete Preliminary Report appeared in *L'Enseignement Mathematique,* and a translation by the author (of this article) in *School Science and Mathematics,* February, 1909.

should the ends to be attained be purely practical?

Necessarily also some large educational problems are touched which concern the whole school organization. Mention may be made of the new types of schools and of the subject of coeducation.

The committee proposes to examine anew and with care what are the branches of this science most able to contribute to general culture. What is the necessary minimum in arithmetic, algebra, geometry and trigonometry, as well as in descriptive and projective geometry, analytic geometry and the calculus? What new ideas must be introduced and what old ones should be discarded?

The much-discussed laboratory method of teaching mathematics requires close inspection. Are there not inconveniences and dangers that result? In what measure may the conventional limits which exist between certain subjects of pure mathematics be made to disappear? What have been the results of the attempts to teach algebra and geometry together? geometry and trigonometry? differential and integral calculus? Careful study needs to be made of the points of contact of mathematics with drawing, with the applied sciences, with philosophy, and with the problems of daily life.

To what extent should paper-folding, observational geometry, logarithms, graphics in algebra and the slide rule be used? Those who desire a close relation between mathematics and physics ought to show exactly what geometrical notions have a direct bearing on physics and to cite those problems of elementary physics which require simultaneous linear equations, equations of the second degree in one or more unknowns, irrational quantities and progressions.

To what degree is it possible to accord a larger place to the historical development of mathematics and to the history of the teaching of mathematics? The extensive literature on mathematical recreations might be made useful. What are the means which will give mathematics a better place in popular instruction and enable the subject to overcome popular prejudices?

The progress of teaching depends directly on the preparation of the teachers. So the committee believes that it will be useful to take account of the reforms, actual or projected, which have in view the training of teachers conformably to modern conditions. In this connection the sex of the teacher for different schools, the introduction of the teacher to scientific research, and the amount of character of the pedagogical training are questions of fundamental importance.

The high plane of this investigation is indicated by the scientific standing of the three members of the central committee as well as by the personnel of the American delegation. These men are announced by Professor Klein to be the following: Professor William F. Osgood, Harvard University; Professor David Eugene Smith, Columbia University; Professor J. W. A. Young, Chicago University.

Preliminary work is to be begun immediately; the commission as a whole to meet during the Easter recess of 1911 preliminary to making a final report to the International Congress of Mathematicians, which is to meet at Cambridge, England, in 1912.

Some may regard the work of the commission as initiating a great reform movement. Reform does not come by commission; rather this development emphasizes the great movement towards vital instruction which has been in progress for over a century. The important work of the commission will be to gather together the valuable contributions from all the world and to make them available to all the world. To select the good and discard the worthless is no small task but one well worthy of the best efforts of the leaders in mathematical thought.

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Lieutenant Shackleton's Antarctic Expedition

The Wellington, New Zealand, correspondent of the London *Times*, has cabled some details of the scientific results of the Shackleton expedition.

The frozen glacier-eroded lakes near Cape

Royds abounded in diatoms, rotifers, water bears and infusoria. Numbers of rotifers which were examined microscopically had been frozen into the ice at temperatures below zero for three years; yet after a few minutes' thawing out they suddenly revived and began eagerly devouring the fungus which abounds in these lakes. In some cases only the body, not the head, of the rotifer appeared to come to life. Several rotifers were similar to those already described by Murray as having been found at Spitzbergen and Franz Josef Land. The water bears came to life in the same manner.

On the black lava rocks of Mount Erebus which had absorbed the sun's heat the snow melted at temperatures below zero and at a height of 9,000 feet. This explains how lichens and similar plant life are enabled to flourish in the Antarctic regions.

The marine fauna near Cape Royds bears a resemblance to the types of animal life of the coal measure series found in Australia and Tasmania. Specimens will be examined by scientific specialists in New Zealand and Australia.

The northern expedition found masses of marine muds 40 feet above the sea level. These contained vast numbers of foraminiferal shells. The biloculina type, which form the biloculina ooze of the Arctic Circle, are specially abundant.

The geological discoveries disprove the Antarctic archipelago theory. The continental plateau extends from the newly discovered mountains 45 miles west of Cape Royds and the magnetic pole to beyond the south pole itself, probably over 1,800 miles. By far the most interesting geological discovery is that of coal measures in latitude 85°; these measures 1,500 feet thick, contain seams of coal 1 foot to 7 feet thick. The microscopic examination of the mineral charcoal which has been secured may indicate its geological age. Rounded quartz pebbles and the great thickness of the sandstone formation imply the action of running water prolonged through many ages. The limestone discovery at the farthest south, interstratified with a remarkable rock of pinkish gray, branded with dark green, unlike any that Professor David has ever seen, may prove important under microscopic examination. The ancient rocks examined apparently contain monazite.

Near Mount Larsen an interesting deep green mineral was found, which is almost certainly a compound of vanadium. Mount Erebus, like Stromboli, proved a good barometer, the steam column ascending and eruptions occurring with a low barometer. At periods the active crater contained molten lava. The old crater was filled almost to the brim with layers of snow. There are millions of felspar crystals 3 inches to 4 inches long, and pumice lava is of a rare kenite type. Fossil radiolaria were found in erratics of banded chert near Cape Royds. Lieutenant Shackleton is sending specimens of all these rocks to the British Museum. The exact location of the magnetic pole was fixed by elaborate triangulation by Mr. Mawson, extending over 200 miles from Mount Erebus to Mount Melbourne. It proved that the magnetic pole is no longer moving eastward as in Ross's time, but is now traveling northwestward in much the same direction as the north magnetic pole.

The summit crater of Mount Erebus was very active as regards steam and sulphur gases. No molten lava was seen, but during a big eruption in June and until September the steam column was glowing like a huge beacon fire, indicating that there was molten lava in the crater. Recently ejected "bombs" were found lying on the new snow, large quantities of sulphur being formed in the crater.

The coal measures discovered far south are probably older than the Tertiary Period; indeed, judging from the induration of the rock, they apparently date back to paleozoic times. No fossils to settle the point have been found, but a microscopic examination of the specimens may solve the problem.

THE RESIGNATION OF PRESIDENT ANGELL

THE regents of the University of Michigan have passed the following resolution:

This board has received with regret the assurance of our beloved president, Dr. James Burrill

Angell, that the time has come when, in his judgment, he should be permitted to retire from the active direction of the affairs of this university.

We desire to record here and now some measure of our appreciation of his services to this institution, of which he so long has been the head.

It is now nearly thirty-eight years since he assumed the presidency of this university. Under his leadership it has grown in student attendance from about 1,200 to more than 5,000, with a corresponding increase in faculty membership. Its advance in effectiveness of educational work and in all that goes to make a university great has been no less prominently marked. The proud position which this university has attained is due, more than to all other elements combined, to the fact that for more than one half its entire life it has been blessed with his learning, his culture, his wisdom, his tact, and, above all, with the example and inspiration of his high-minded Christian character.

It is impossible to calculate the impress for good given to the world by the 40,000 men and women who have carried with them from this institution into their work and in their lives the commanding influence of his rich character and personality.

Proud as he may justly be of the homage which the world justly yields him as educator, diplomat and publicist, he has even greater cause for pride in the grateful affection of the people of this state, whom he has served so long and so abundantly, and in the love of the army of students, whose lives he has directly enriched and to whom he will always stand for all that is highest and best in scholarly attainments, in private character and in public and private citizenship.

The women of the University of Michigan, at their annual banquet, held at Barbour Gymnasium on April 2, passed resolutions, the first part of which read:

This occasion on which you, in your official capacity, address for the last time the body of women of the University of Michigan marks an era in the higher education of women, not alone in this commonwealth, but in America. Your assumption of Michigan's responsibilities was contemporary with our entrance into its opportunities. We were a hazardous experiment given into your hands in the face of a skeptical world. There are no adequate words to express our gratitude for your unswerving loyalty to that trust. We give you increasing homage and reverence for the gifts of genius with which you have wrought in our behalf. Yours has been, for two score years, the most potent influence in the land for the unrestricted privilege of higher education for women; yours the simplicity before which self-consciousness vanished; yours the fine courage that has helped many a sinking purpose to effective conclusion; yours the felicitous word that has parried the criticism of an over-expectant world, and has signally won where more militant methods would have lost.

SCIENTIFIC NOTES AND NEWS

The spring meeting of the council of the American Association for the Advancement of Science will be held in the Assembly Hall of the Cosmos Club, Washington, D. C., on the afternoon of Wednesday, April 21, 1909, at 4.30 o'clock.

The annual session of the National Academy of Sciences will be held in Washington, D. C., beginning Tuesday, April 20, 1909, at 11 A.M. The place of meeting will be the Smithsonian Institution. The public sessions for the presentation of scientific papers will be held in the large hall of the National Museum on Tuesday and Wednesday afternoons, April 20 and 21.

The American Philosophical Society, Philadelphia, will hold a general meeting on April 22, 23 and 24. The opening session will be held on Thursday afternoon, at 2 o'clock in the hall of the society in Independence Square. A Darwin commemoration will be held on Friday evening at 8 o'clock in the Hall of the Historical Society of Pennsylvania followed by a reception. The afternoon session on Saturday will be devoted to a symposium on earthquakes. The annual dinner of the society will be held at the Bellevue-Stratford, on Saturday evening.

Professor T. G. Bonney, F.R.S., will succeed Professor J. J. Thomson, F.R.S., as president of the British Association and will preside over the meeting to be held at Sheffield next year.

The London Geographical Society has awarded its Victoria Research medal to Mr. Alexander Agassiz. The society has awarded a special medal to Lieutenant Ernest H. Shackleton.

THE John Fritz medal for 1909 has been awarded by the committee of the national engineering societies to Mr. Charles T. Porter, of Montclair, N. J., for his work in advancing the knowledge of steam engineering and in improvements in engine construction, especially in high speed engineering. The first medal was awarded in 1903 by the board of award organized by the admirers of Mr. John Fritz, the eminent engineer, on the occasion of his eightieth birthday. The other recipients thus far have been Lord Kelvin, Thomas A. Edison, Alexander Graham Bell and George Westinghouse.

THE Mikado of Japan has bestowed on President Eliot the decoration of the Order of the Rising Sun, first class.

MANCHESTER UNIVERSITY has conferred its doctorate of laws on Professor Walter Baldwin Spencer, professor of biology in the University of Melbourne and known for his anthropological researches on the native tribes of central Australia.

PROFESSOR FERDINAND ZIRKEL, for nearly forty years professor of mineralogy and petrography at Leipzig, has retired from active service.

DR. JULIUS HANN, professor of cosmical physics at Vienna, has celebrated his seventieth birthday.

AT the meeting of the American Association of Pathologists and Bacteriologists, held last week at the Harvard Medical School, Dr. Frank D. Mallory, assistant professor of pathology of the Harvard Medical School, was elected president for the meeting to be held next year at Washington.

PROFESSOR F. D. FULLER, chief chemist, Pennsylvania Department of Agriculture, Harrisburg, Pa., has been appointed chief of the cattle food and grain investigation laboratory, Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C., and assumed the duties of his position on April 1.

UNIVERSITY COLLEGE, Oxford, has awarded the Radcliffe prize for 1909 to Mr. Arthur Frederick Hertz, Magdalen College, for his dissertation on the physiology and pathology of the movement of the intestines.

DR. HERMON C. BUMPUS, director of the American Museum of Natural History, has received letters from Dr. R. M. Anderson and Dr. V. Stefansson, explorers for the museum on the extreme north coast of Alaska. The letters were dated October 15.

TWO assistant curators of the Field Museum of Natural History, Messrs. S. C. Simms and F. C. Cole, are to take up the ethnological investigation in the Philippines interrupted by the recent murder of Dr. William Jones.

THE Phi Beta Kappa address at Columbia University will be given by Dr. A. Lawrence Lowell, president-elect of Harvard University.

SENOR JOAQUIM NABUCO, ambassador from Brazil to the United States, will deliver the baccalaureate address at the University of Wisconsin.

DR. GEORGE H. PARKER, professor of zoology at Harvard University, gave a series of six lectures at the University of Illinois, March 29 to April 3, on the subjects of coral islands, the functions of the ear in fishes, and the origin of the nervous system.

THE third meeting of Research Workers in Experimental Biology, of Washington, D. C., was held at the Medical Department of George Washington University, on April 3, when Dr. Leo Loeb, assistant professor of experimental pathology in the University of Pennsylvania, read a paper on "The Experimental Production of Maternal Placenta."

SIGMA Xi Honorary Fraternity at the University of Pennsylvania initiated its new members in the Randal Morgan Laboratory on April 7. Previous to the exercises old members and new assembled in the auditorium, where Mr. H. Clyde Snook, of New York, delivered a lecture on "The Mechanical Rectification of One Million Volts."

THE Woman's College, Baltimore, in conjunction with a committee of the alumnæ association, has arranged a course of lectures on "Nutrition." The first were given last week by Dr. William J. Gies, of the College of Physicians and Surgeons of New York. Other lecturers are to be: Dr. Henry C. Sherman, New York; Dr. William H. Howell, Johns

Hopkins University; Dr. H. P. Armsby, State College, Pa., and Dr. C. W. Stiles, Washington, D. C.

The Oliver-Sharpey lectures of the Royal College of Physicians, London, have been given by Professor C. S. Sherrington, F.R.S., on "The Rôle of Reflex Inhibition in the Co-ordination of Muscular Action."

Professor Henry Jones, on behalf of a committee, appeals for funds towards a memorial of the late Dr. Edward Caird in the University of Glasgow—to place an inscribed tablet in the moral philosophy classroom, and to supplement the endowment of the lectureship in political philosophy.

The regents of the University of Kansas have named the entomological collections of the university the Francis Huntington Snow Entomological Collections, in honor of the late chancellor of the university.

Dr. Persifor Frazer, well known as a chemist, geologist and mining engineer as also for his studies in handwriting, died at his home in Philadelphia on April 7, at the age of sixty-three years. Dr. Frazer had been connected with the United States and Pennsylvania Geological Surveys and was at one time professor of chemistry in the University of Pennsylvania. His father was professor of natural philosophy and chemistry in the university and one of his sons is now instructor in chemistry in the institution.

Mr. Charles Aldrich, a fellow and one of the founders of the American Ornithologists' Union, died at Boone, Iowa, on March 8, at the age of eighty years. In addition to ornithology, Mr. Aldrich was interested in local history and had been curator of the State Historical Department at Des Moines, Iowa.

Dr. Arthur Gamgee, F.R.S., emeritus professor of physiology, University of Manchester, and late Fullerian professor of physiology in the Royal Institution, died in Paris on March 29, aged sixty-seven years.

Dr. van Heuvek, director of the Zoological Gardens at Antwerp, has died at the age of seventy-one years.

Dr. Ludwig Thanhoffer, professor of anatomy at Buda Pesth, has died at the age of sixty-six years.

The U. S. Civil Service Commission announces an examination on April 21, to fill three or more vacancies in the position of laboratory assistant (in chemistry) and assistant chemist in the Bureau of Standards, at salaries varying from $900 to $1,200 per annum for laboratory assistant, and from $1,400 to $1,800 per annum for assistant chemist. The duties in connection with these positions vary from routine testing to advanced work involving original investigation. As far as practicable, appointees are assigned to work in the subjects for which they are best fitted.

The *Bulletin* of the American Mathematical Society states that the Deutsche Mathematiker-Vereinigung now includes 725 members, of whom 60 are Americans. The Circolo Matematico di Palermo has a membership of 635, of whom 105 are Americans.

The annual meeting of the German Bunsen Society of Applied Physical Chemistry is to be held at Aachen on May 23–26, immediately before the International Congress of Applied Chemistry in London.

Under the will of Elizabeth F. Noble, of Mansfield, Mass., bequests of $10,000 each are made to the American Society for the Prevention of Cruelty to Animals and the American Anti-vivisection Society, $5,000 goes to the Massachusetts Society for the Prevention of Cruelty to Animals, and after other sums are paid, the three societies are to share in the residue of the estate.

The daily papers state that the Jesuit Fathers have decided to install a complete apparatus in twelve colleges belonging to their order in this country to take earthquake records.

Plans are maturing for a large exposition to be held in Buenos Ayres in May and June of 1910, on the occasion of the centennial celebration of the independence of the Argentine Republic.

All paleontologists are interested in the discoveries in the Permian of northern Russia,

and are awaiting eagerly publication of the results arrived at by Professor Amalitzky. The kinship which these remarkable animals bear to those of the Permian of North America and of South America renders the problem one of international importance. The only figures which have been published are those which appeared through the courtesy of Professor Amalitzky in a popular work by Sir Edwin Ray Lankester. All the collections have now been transferred to the Museum of the Academy of Sciences of St. Petersburg, which will be their permanent home. Professor Amalitzy is, however, the director of the Polytechnic Institute of Warsaw.

ILLUSTRATED lectures will be delivered in the lecture hall of the museum building of the New York Botanical Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

April 24—"A Winter in Jamaica," by Dr. William A. Murrill.

May 1—"Spring Flowers," by Dr. Nathaniel L. Britton.

May 8—"How Plants Grow," by Dr. Herbert M. Richards.

May 15—"Evergreens: How to Know and Cultivate Them," by Mr. George V. Nash.

May 22—"Collecting Seaweeds in Tropical Waters," by Dr. Marshall H. Howe.

May 29—"Vanilla and Its Substitutes," by Dr. Henry H. Rusby.

June 5—"The Selection and Care of Shade Trees," by Dr. William A. Murrill.

June 12—"The Ice Age and Its Influence on the Vegetation of the World," by Dr. Arthur Hollick.

June 19—"Haiti, the Negro Republic, as seen by a Botanist," by Mr. George V. Nash.

June 26—"Some American Botanists of Former Days," by Dr. John H. Barnhart.

July 3—"An Expedition up the Peribonca River, Canada," by Dr. Carlton C. Curtis.

July 10—"Collecting Experiences in the West Indies," by Dr. Nathaniel L. Britton.

ACCORDING to the New York *Evening Post* a valuable archeological collection has recently been installed in the museum at Vanderbilt University as the gift of General Gates P. Thruston. The relics include specimens from Tennessee, Missouri, Arkansas and other southern states and Indian relics from Peru. A number of specimens were taken from mounds near Nashville, Tenn., and show such skill as to point to some higher civilization than that of the Indians who dwelt there in historic times. The Peruvian relics show so close a resemblance to these remains that the theory of kinship between the makers of this pottery and the people of Peru has been advanced. In addition to the Indian relics, there are many minerals, gems and semi-precious stones. The collection is arranged in a room of University Hall to be known as the "General G. P. Thruston Room."

A NEW index map of Alaska, showing areas covered by topographic surveys, has been issued by the U. S. Geological Survey. On the back of this map is printed a list of the survey's publications on Alaska, arranged geographically. These publications comprise 28 maps and 119 reports. The work of the Geological Survey in Alaska, begun in 1898, has been indispensable to the development of the mineral resources of the territory. The value of the mineral output of Alaska to date is approximately $148,000,000, including the values of gold, silver, copper, coal, tin, marble and other minerals. The cost of the survey's explorations in the territory has been less than three tenths of 1 per cent. of the total value of the mineral productions. Since 1898 areas in Alaska amounting to 121,252 square miles have been topographically surveyed on a scale of four miles to the inch and 2,732 square miles on a scale of one mile to the inch. These surveys cover, respectively, 20.85 and 0.47 per cent. of the total area of Alaska, which is 586,400 square miles. During the same period geologic reconnaissance maps have been made of 99,350 square miles and detailed geologic maps of 2,304 square miles. In addition to this work, practically every mining district in Alaska has been examined, and some have been mapped in great detail. The water resources of some of the important placer districts have also been studied and the results published.

ON the invitation of President Edmund J. James, a conference was held at the University of Illinois on March 31. The conference considered the needs of the state in out-of-door improvement, both for the home and the

municipality and a state organization for this purpose was effected. The following objects and plans were considered:

1. To circulate information through publications originating with the organization and wherever procurable. These should discuss topics upon which the people want information, the kinds and uses of ornamental plants, insect enemies, the arrangement of the farm and suburban home, the practical problems of street, play ground, park and cemetery development, the customary methods of improvement organizations and kindred subjects.

2. To promote, where requested, the formation of village, municipal and neighborhood improvement and similar societies, park boards and parkway associations and to assist them within its field.

3. To advise upon the instruction of landscape gardening and ornamental horticulture, both professional and elemental in the University of Illinois and to assist in similar courses given elsewhere in the state.

4. To contribute lectures upon the subject throughout the state when requested.

5. To advise upon experiments in the hardiness and usefulness of ornamental plants in the different latitudes of the state and to encourage the creation in some form of small public plant gardens where the ornamental use of trees, shrubs and flowers can be readily studied.

6. To frame and secure necessary legislation which shall promote out-of-door art.

A COLLECTION of British birds' eggs has been presented to the Natural History Museum of Aberdeen University by Mr. R. Hay Fenton, London, a native of Aberdeen. The collection contains specimens of practically every British bird, and includes an egg of the great auk. It numbers upwards of 7,000 specimens.

THE American Museum of Natural History has recently acquired, through purchase from Mr. G. R. Cassedy, of Cañon City, Colo., an iron meteorite that will form a valuable addition to the series of meteorites in the foyer of the museum. The specimen, which weighs 682 pounds, was found November 11, 1907, in Fremont County, Colorado.

PROFESSOR W. M. DAVIS, of Harvard University, read a paper on March 22, before the Royal Geographical Society, London, on "The Colorado Canyon." At the meeting of the society on April 5, Sir Harry Johnston gave a lecture on the scenery of Cuba, Haiti and Jamaica, with illustrations from photographs taken by him.

WE learn from the London *Times* that the members of the committee of the ill-fated Danmark Arctic expedition have raised a sum of £1,250, which, if the government will provide a similar amount, will be sufficient to despatch a small motor-yacht expedition to northeastern Greenland to search for the diaries and sketches probably left at Danmark Firth by M. Mylius Erichsen, the leader of the Danmark expedition, and his companions MM. Brönlund and Hagen, who perished in an attempt to cross the inland ice in winter. The plan was set on foot by the well-known Arctic explorer Captain Ejnar Mikkelsen, who will be the leader of the new expedition, which, according to the intentions of the committee, will consist of seven persons, and will start from Copenhagen about June 15, 1909, returning in the autumn of 1910.

WE learn from the London *Times* that the British Ornithologists' Union has decided to undertake a zoological exploration of the interior of Dutch New Guinea. Dr. Lorentz, who is once more on his passage out to New Guinea, has been recently up the Noord River, and mapped some of the ranges lying south of the Charles Louis Mountains, but his aims were geographical rather than zoological. The direct objective of the new expedition will be the Charles Louis Mountains, a snow-capped range forming part of the great central system stretching across the island from east to west. These are the Snow Mountains of the Dutch, and the highest peak is given on the most recent map as 17,000 feet. It is proposed that the expedition shall leave England about June, and every endeavor will be made to provide for a clear year's work. Mr. Walter Goodfellow, whose name is known from his collecting journeys in New Guinea, will be in command of the expedition, and his assistants, Mr. Stalker and Mr. Wollaston, have had some previous experience in the island. To these it is intended to add two specially-selected men, so that all branches of zoology and botany, and also of geography, may be

represented. Mr. Stalker is now on his way to the Aru Islands, where he will collect for Sir William Ingram, for whom, it will be remembered, he brought home the Prince Rudolph bird-of-paradise, which was exhibited at the Zoological Gardens last year. When his contract with Sir William is completed he will go over to the Ke Islands, and work there till the arrival of Mr. Goodfellow's party in New Guinea, when a start will be made from the south coast, just under the highest-known point of the central range. A small committee, consisting of Dr. F. D. Godman (president of the British Ornithologists' Union), Dr. P. L. Sclater (editor of the *Ibis*), Mr. E. G. B. Meade-Waldo, Mr. C. E. Fagan (treasurer) and Mr. W. R. Ogilvie-Grant (secretary), will deal with the results of the expedition. The expenses for one year's exploration have been calculated at £3,000, of which about half has been subscribed or promised.

UNIVERSITY AND EDUCATIONAL NEWS

THE legislature of Nebraska made appropriations for the State University for the biennium 1909–11 as follows: from the "one-mill university levy," for general expenses, salaries, etc., about $750,000; from the general fund—for a site for the medical college, $20,000; for experimental sub-stations (3), $45,000; for farmers' institutes, $20,000; for permanent improvements, additional land, etc., $100,000.

THE following letter has been addressed by Mr. Andrew Carnegie to the president of Hamilton College:

> In recognition of the unique services of Elihu Root as Secretary of State in the cause of international peace, through arbitration treaties negotiated by him, and in various other directions, I give the sum of $200,000 to Hamilton College, the institution of which he and his two brothers and also his two sons are graduates, and of which his father was so long a distinguished professor. In accordance with the wish of Mr. Root, this sum is to be held and invested by the trustees of the college as a trust fund, the income to be devoted to the salaries of the instructors of the college. It is to bear the name of the Elihu Root Peace Fund.

OUT of the $260,000 recently secured by Knox College ($50,000 from the General Education Board, $50,000 from Mr. Carnegie and $160,000 from the alumni and friends of the institution), $50,000 is to be used in building a Science Hall. It is expected that work will begin on this building the present season.

THE last legislature appropriated money to establish six new graduate fellowships at $500 each at the University of Kansas. They are open to teachers in Kansas colleges and to superintendents and principals of Kansas schools, who are graduates of colleges and universities of recognized standing and who have shown preeminent qualification for advanced work. A large glass company with head offices in New York City has offered $1,500 a year for two years for a fellowship for a research student working on "The optical properties of glass in relation to its chemical constitution."

MR. F. G. THOMPSON, of the class of 1897, has presented Harvard University with $50,000, for salaries in the department of history and government.

THE directors of the Krupp's Works at Essen have made an annual grant of 10,000 Marks for the aeronautic professorship at Göttingen University, to be devoted to research work connected with aeronautics.

ON recommendation of the chancellor and regents of the University of Nebraska, the legislature of the state has amended the charter of the institution so as to allow the regents to establish the following colleges, viz: (1) The Graduate College; (2) The College of Arts and Sciences; (3) The College of Agriculture; (4) The College of Engineering; (5) The Teachers College; (6) The College of Law; (7) The College of Medicine. The first named, which has hitherto been called the Graduate School, is now raised to the dignity of a college. The name of the second college has been shortened from College of Literature, Science and the Arts, to College of Arts and Sciences. The third and fourth colleges have hitherto constituted the Industrial College, and this name will now disappear, giving place to the colleges of Agriculture and of Engineering.

In the Nebraska legislature the joint resolution accepting the Carnegie pensions for the State University was defeated, although it was passed in the senate by a vote of 25 to 8. In the house it was opposed by Mr. W. J. Bryan, and was lost by a vote of 47 to 51. The matter now goes over to the next legislature.

The University of Colorado Mountain Laboratory, a department of the university's summer school, opens a six-week session on June 14, under the direction of Dr. Francis Ramaley. It is situated at Tolland, Colo., at an altitude of 8,889 feet. Courses are offered in general biology, nature study, plant ecology, anatomy and taxonomy and special lectures will be given on forestry, ornithology, physiology, climatology, glacial geology, photography and map-making.

The Rev. Dr. Marion Leroy Burton, pastor of the Church of the Pilgrims, Brooklyn, has been offered the presidency of Smith College, to succeed the Rev. Dr. L. Clarke Seelye.

At the College of Physicians and Surgeons, Columbia University, Dr. R. Burton-Opitz, adjunct professor of physiology, has, on the retirement of Professor John G. Curtis, been appointed head of the department of physiology. In the department of the practise of Medicine, Dr. Walter B. James has, at his request, been transferred from the Bard professorship, which involved the administration of the department, to a professorship of clinical medicine, and Dr. Theodore C. Janeway and Dr. Evan M. Evans, now associates in medicine, have been promoted—Dr. Janeway to the Bard professorship and Dr. Evans to a newly created professorship of clinical medicine.

Dr. George H. Ling, of the department of mathematics, Columbia University, has been advanced to the rank of adjunct professor.

At Cornell University, Professor H. H. Norris has been appointed professor of electrical engineering in charge of the department.

The professorship of physics at Lafayette College, made vacant by the death of Professor James W. Moore, M.D., has been filled by the appointment of Professor Clarence McCheyne Gordon, Ph.D., now professor of physics at Center College of Central University, at Danville, Ky.

Dr. Hermann Dürck, of Munich, has been appointed professor of pathological anatomy at Jena.

DISCUSSION AND CORRESPONDENCE

WILLIAM KEITH BROOKS

To the Editor of Science: Professor Andrews's tribute in your issue of December 4, 1908, gave the first sad intimation to western readers of the death of Dr. Wm. K. Brooks, and very acceptable information concerning his later years, much of which was news to the present writer by reason of enforced separation in work and experience. Knowing thoroughly the innate worth of the man, from intimate relations as a companion of early youth, neighbor, schoolmate and associate in early scientific work, I am minded to record a few facts which have direct bearing upon the cost to himself of Brooks's contributions to biology.

In all his training at home, in school and at college, he was rigidly surrounded with influences adverse to original research or to scientific study. His mother died before his bent had become sufficiently pronounced to arouse opposition, and it is doubtful if she would have essayed to thwart him, for she was a lady of rare qualities and keenly sympathetic with her children's dispositions. His father and his stepmother were strong adherents to the unyielding utilitarian ideas of the times, and could not then recognize the full meaning of the struggle of the youthful mind.

In 1875, near the period of culmination of the strife engendered by Darwin's work, it was no light thing to withstand the well-meant resistance of good friends who could see naught but wickedness in the new ideas. Then Brooks's character shone brightly to those who knew him best. It was, perhaps, a very little result which came from the session of the Kirtland Summer School of Natural History, in Cleveland, in that year. But it signified much more than was apparent. It was the outcome of many earnest discussions by Brooks and the writer, after some consultation

with the then aged Dr. Jared P. Kirtland. We decided to ask the Kirtland Society of Natural History to act as sponsor for our plans. Although this was conceded, and an effort was made to finance the project, it was but a gloomy outlook before the volunteer instructors when the students began to register. Albert H. Tuttle, now professor in the University of Virginia, Wm. K. Brooks and the writer, all then earning a scanty living by work not germane to the task, came before the little band of students almost empty handed. Certain influential members of the Kirtland Society had successfully prevented our use of the society's working rooms, on the ground that the smells and refuse from dissections would annoy other tenants and injure the building. The officers endeavored to raise funds, but the subscription papers headed by them were signed for such small sums that those who might otherwise have given more freely were limited by them. The money actually secured would not cover the cost of collections, to say nothing of freight and other expenses. We decided to put on a bold front, and to start with such home material as we might individually collect or purchase in local markets. But it was found impossible to rent other quarters, owing to prejudice against our "bloody" work. After anxious consultations, the plan suggested by Brooks was adopted. We would hold field sessions and depend upon enthusiasm and contact with nature to somehow work out results. As a last resort, it might be possible to utilize the barn of good old Dr. Kirtland, miles out in the country.

At this juncture there came forward keen-sighted men whose memories should be revered by all who have made sacrifices for science. Andrew J. Rickoff, then superintendent of schools of Cleveland, urged the board of education to offer free use of the Central High School Building and its appurtenances to us, as three of its former pupils, during the vacation. A resolution was passed, referring the matter to the superintendent of buildings, with power, provided that all damages accruing from dissections, etc., be made good by the summer school. There were pressures of the hand, words of encouragement and quiet exercises of influence from the great-hearted Rickoff which gave inspiration to Brooks in his splendid work of that summer. Leonard Case, owner of the building occupied by the Kirtland Society, had at first approved the use of the society rooms by the school. The adverse influences, and more particularly the objections of tenants, had caused him to rescind this privilege. He had not personally subscribed to the sustaining fund, and no one regarded him as in any way favorably inclined to our project. It was a gloomy outlook which confronted the instructors on the day before the opening, when only three teachers (from Indianapolis) had registered (Dr. David Starr Jordan was probably responsible for these). The writer, as editor of a "science column" in the Cleveland *Herald,* had published widely the plans and this appeared to be the sole outcome of months of labor and sacrifice. Mr. Benedict, proprietor of the *Herald,* and J. H. A. Bone, its talented editor, had given warm support liberally in print and by those little words which lie stored forever in memory. But to Brooks and us the apparent misunderstanding of Leonard Case was a most disheartening blow.

I can never forget the conference with Brooks in the office of the Kirtland Society, where the gross results were canvassed towards evening of that day. In words like these he spoke: "I am glad there are three of them—one apiece, all women. What could we have done—we three—if there had been but one? Three teachers, well trained, means the sowing of seed which shall yield a harvest none can measure."

We parted for the night. Left alone and heartsick, I saw Leonard Case enter the room as if he were about to do something mean. He asked "How did you come out?" "Oh, fairly," was the reply. "I don't suppose you got any too much for collections and excursions, did you?" He was told that we could manage somehow. Then he blushed and appeared ill at ease, remarking that he had regretfully kept us out of the rooms and that he had watched our work and knew with whom

he was dealing. "I don't believe you will have any trouble in finding use for a little more. Here is a trifle for you to apply, on just one condition. Put it in your pocket and expend it as you choose. Make no note of it in your accounting." He left, with a rough yellow envelope sealed in my hands. This contained seven bills of $100 each. The total contributions raised outside of this did not amount to $200, as I recall.

And the school grew. The work of Brooks was prophetic of his future career. Collections and excursions and dissections were made possible. Dr. John S. Newberry gave us two lectures on geology which were beyond and above any I ever heard for concise completeness. If from this poor little effort there came forth no other good than the launching of Brooks upon his most worthy career, it is honor indeed to have shared in the cost thereof.

Theo. B. Comstock

Los Angeles, Cal.

SCIENTIFIC BOOKS

Histologisches Practicum der Tiere. By Dr. Karl Camillo Schneider, A. O. Professor in the University of Vienna. With 434 text-figures. Jena, Gustav Fischer. 1908.

In view of the excellence of the first edition of K. C. Schneider's histology, which appeared about six years ago, students of the subject will welcome this new edition recently published by Fischer in Jena. The wide circulation of the first edition, together with the importance attached to it by all scientists, will enable the writer to more easily review the last edition by some slight reference to the first.

In general, it may be said that the author has endeavored, by shortening his "Lehrbuch der vergleichenden Histologie," and by slightly rearranging it, to make it more practical and to adapt it to the use of university students taking a "course" in the subject. While doing this, some of the subject-matter has been rewritten to accord with the results of recent research, and some entirely new work has been added.

The first or general part of the work opens, after the preface, with an introduction, in which the subject is defined and the view-point and method of treatment outlined. This discussion is concluded (p. 5) with two ideas which give the author's conception of histology and, of necessity, fix the form of arrangement of the whole book. The first idea is that histology should concern itself only with structure or form and should be studied and treated without regard to function. Secondly, that being a fundamental morphological study, it underlies any natural scheme of classification. The reviewer presumes that by "natural classification" is meant the classification founded upon blood relationship through evolution.

The reviewer does not wish to criticize this conception as the guiding principle in a histological course, being fully impressed with its educational value in a book so well executed as that under review. He does, however, wish to call attention to another view, held by some workers including himself, which looks upon histological structure as the important machinery through which the varied functions of organisms are performed and life is maintained. Such a view, which lays special stress on the cytological and chemical side of histology without making it altogether a study of physiology, has prompted the writing of such text-books as Prenant's "Traite D'Histologie" and Martin Heidenhain's "Plasma und Zelle." The introduction concludes with a discussion of some of the principal features of animal morphology or "Architektonik," followed by a systematic arrangement of the animal kingdom on this basis.

The remainder of the "general part" is taken up with an account of the structure of the cell, of cell division, and of the working substances of the cell; also a special account of the various groups of cells (under eleven types) and a very short account of some general principles of tissue and organ building, this latter being the last of the "general part" of the work which occupies 75 pages out of the entire 518 in the volume. When we notice that this "general part" occupied 240 pages in the former edition instead of 75, it can be seen how greatly this portion of the present edition has been reduced. This reduction has

been effected, chiefly, by cutting out about 30 pages on special organology, and 60 pages on "Architektonik" or morphology; also by omitting many figures and parts of the descriptive matter, as well as changing other parts. Some new paragraphs, mostly of a historical nature, have been inserted.

The second part of the book or "special part" deals with the descriptive histology of some 40 animal types taken in almost systematic order. The entire histology of each form is seldom discussed, but only such portions as are characteristic, or as fill out gaps in the rather rough and incomplete system of tissue classification, are described in the author's thorough and scholarly way. The whole part is divided, very arbitrarily, into 50 lessons as a convenience to teaching.

This special part is, of course, the largest and most substantial part of the book. To estimate very crudely the amount by which it has been reduced from the corresponding part in the old edition, it may be said that in the latter it occupied 685 pages, while in the new form it is contained in 445 pages. This reduction has been secured by taking out descriptions of a few entire forms and of certain of the tissues of other forms. Care has been shown in doing this, as a rule, to remove those parts which in any sense duplicated or paralleled other parts.

Comparatively little has been added to this part of the book, although it has been carefully worked over and much changed in many details. One improvement consists of the addition in several places of appropriate details of histogenesis. The omission of any allusion to the comparatively rare but important tissues that produce light and electricity is a disappointment to the reviewer; the more so that other rare tissues of possibly less fundamental importance have been left in, as a quite extensive account of the structure and development of the nettle cells of *Physophora*. All reference to gas secretion has been omitted, although it was treated of in the first edition and is a matter of scientific importance.

The index is short, too short even when one considers that the method of arrangement and table of contents both supply much that is omitted in its numbers. As an instance, a student or research man would have to search through nine pages of text to find the concise but valuable account of muscle structure in *Peripatus* (pp. 131–132), there being no indication of this item in index or table of contents. Were he to start on a comparative study of muscle he would have to search carefully in other places as well. This also holds true for other tissues.

Personally the writer would have preferred to see an enlarged edition of the former "Lehrbuch," strengthened by certain additions and revisions. One can not help feeling that the new edition is, in part, a sacrifice of scientific ideals to practical or even commercial demands. An advanced student should really have the old edition as well as the new, even if he should not prefer the first edition outright. It is to be hoped that the author will, in the near future, give to advanced students of scientific histology a third and fuller edition.

The printing, figures and general make-up are all that can be desired, and the very few errors of typography and lettering are a negligible quantity; the bibliography is full and complete. The book should be in the hands of every advanced student of histology as well as of other zoological subjects.

ULRIC DAHLGREN

Probleme der Protistenkunde. I. Die Trypanosomen ihre Bedeutung für Zoologie, Medizin und Kolonialwirtschaft. Von F. DOFLEIN, Ao. Professor der Zoologie an der Universität München. Jena, Gustav Fischer. 1909. Pp. 1–57.

Under the above title there has appeared an excellent article on the present knowledge concerning trypanosomes.

The trypanosomes are small one-celled animals bearing a flagellum on one end and an undulating membrane on the side of the body. They are classed under the protozoan group Flagellata. They are parasitic in the blood of vertebrates and cause in mammals serious diseases, such as "nagana," "surra," "dourine" in horses and "sleeping sickness" in man. The pathogenic forms are distributed

principally in South America, Asia and Africa.

Although the parasite has been known for more than half a century, very little importance was attached to it until within the last decade. As knowledge of these forms has recently advanced, so have they become very important, not only to the physician on account of their rôle in the etiology of disease, but also to the zoologist who is desirous of knowing their finer structure, their life history and their genetic affinities.

One of the important phases of the article is a discussion of the method of transmission of the parasite. Doffein points out that there are three probable modes of transmission.

The first mode is by means of cysts or spores. In such cases it would be necessary for the parasites to wander through the walls of the blood-vessels out upon the skin or mucous membrane and there form cysts. They must then be taken up with dust, water or food by an intermediate host and be carried to the vertebrate host. At present no facts are known to support this theory, except that certain authors have described stages in the blood and internal organs, which they interpreted as cysts. But these are probably nothing more than degeneration stages.

The second method is through coitus, as is the case with Spirochæta and the trypanosome causing dourine. Doflein is of the opinion that this mode of transmission may be possible in all trypanosomes, and hence regards it as an important point to be investigated.

The third method is the passive transmission through the agency of blood-sucking invertebrates. Experiments show that insects are capable of passively carrying the trypanosomes from an infected to a sound patient. Since the work of Schaudinn (1904) on the transformations of the owl trypanosome in the stomach of the mosquito, investigators have thought that the trypanosome must pass through a complicated life-cycle in an invertebrate host. Setting out with Schaudinn's work before them, they have tried to fit their discoveries to his interpretations. They have searched for male and female forms, believing that there must be a life-cycle similar to malarial forms in the mosquito. But no one has ever yet seen male and female, if they exist, in process of conjugation, and so the insect is known only to be a passive carrier of the infection.

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The Study of Nature. By Samuel Christian Schmucker. Pp. 315, illustrated. Philadelphia, J. B. Lippincott and Co. 1908. $1.25.

This latest addition to the long list of books designed to guide teachers of nature study will, like many of its rivals, give much help; but still leaves the most pressing problems of elementary school nature study just where they were before its publication. This fact is mentioned not in criticism, but simply to forewarn those who eagerly expect each new book on nature study to make some decided advance towards complete establishment and successful teaching of the subject in all our elementary schools. For such a golden age of nature study we have as yet at most only a prophetic vision.

In the first chapters dealing with the principles of nature study the author follows the most advanced stage of the nature study movement when he urges as essential the observational study of natural things, as far as possible, in their natural relations and chosen for their commonness and abundance rather than for their rarity.

In the chapter on The Real Purpose of Nature Study the author agrees with many other writers in urging nature study as for many individuals a valuable addition to the general culture which is valuable for avocation rather than for the main business of life. Also be believes in practise in accurate observing and stating results as decidedly effective in establishing firm character, and in nature study as a guide to a religious attitude towards nature. All this agrees with the experience of many naturalists, but the doubting educators who have had no experience in scientific study will continue to regard these purposes as vague and not convincing. The

present uncertainties as to the place of nature study in our educational system are to no small extent due to the emphasis on such vague purposes which appeal to few who have not the naturalist's outlook to nature.

Most of the book is devoted to the practical problems of class-room management, materials and arrangement of the course of study. All these chapters are good introductions for the beginner, and especially for students in normal schools. Nine of the ten chapters on materials are devoted to animals and plants, and the tenth deals with popular astronomy. Just why the author has chosen the heavens as the only representative of the physical side of nature is not apparent to the reviewer. The signs of the times indicate that here is a weakness, and that the nature study which may win a permanent place in our elementary education of the future must have a well-balanced mixture of the biological and the physical. The physical is extremely important for interpreting the biological aspects of nature, and to most people it makes a more convincing appeal from the standpoint of every-day life.

The outline of a course in nature study is based on no apparent underlying principles, but like most other outlines published is simply a list of topics taken at random. All principles of continuity, correlation and logical development seem to be neglected. Of course there are those naturalists who urge that nature study should be free from everything resembling the formal work common to the school room; but that kind of nature study has decided limitations and has made little permanent progress in American schools.

MAURICE A. BIGELOW

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Experimental Elasticity, a Manual for the Laboratory. By G. F. C. SEARLE. 8vo, pp. 187. Cambridge University Press. 1908.

The character of this book can be best seen from its origin. The author has been since 1890 director of the classes in practical physics of the Cavendish Laboratory, and has prepared for his students manuscript notes giving the theory and description of the experiments. He is now collecting these notes, and after rewriting and amplifying them when needed, they are to be published in a series of volumes which will cover the usual field of practical physics. It is appropriate that the first volume should be on experimental elasticity, a subject in which Mr. Searle's contributions are well known.

The volume is divided into three chapters, the first two chapters being theoretical and the third chapter giving detailed descriptions of the methods and apparatus of fourteen experiments in elasticity. The theoretical parts are generally elementary, but the use of calculus methods is not avoided. The theorems and methods of thermodynamics are also used. The sections using these more advanced methods could, however, be easily omitted without interfering with the use of the greater part of the book. The "notes" forming an appendix to the above three chapters give discussions of some of the elementary theorems of mechanics and mensuration. From this we can infer that the more advanced sections may have been added later to make the book more complete. The longest of these "notes" is entitled Hints on Practical Work in Physics, and gives brief, pointed directions on keeping note-books, making diagrams, methods of calculations, adding also an occasional moral hint. Thus the following might well be copied and framed for use in many laboratories:

> A steady hand, a keen eye and a good command of the body are essential in accurate physical determinations; mere intellectual power avails nothing by itself. Any rule of life which deviates from temperance in all things (including work) may be expected to render the hand less steady and the eye less keen and so lead to inferior work. University students whose fingers are deeply stained with tobacco do not, as a rule, become skilful observers, though they may show considerable ability in other ways.

Laboratory courses can not in general be transplanted as a whole, since each laboratory has its own selections of apparatus and experiments—that is, if it is a live laboratory. In the case of elasticity, the variations in forms of apparatus are not great and not funda-

mental. Hence this book will be available, particularly as a reference book, in many laboratories. The discussion of elementary elastic theory is excellent and not beyond the average undergraduate. More time is evidently given to elasticity by Mr. Searle's students than is usually possible in American colleges and universities for this part of physics. The only criticism that might be made is that several of the experiments given are very complicated for a practical physics course, but these are added experiments so that none of the standard experiments have been crowded out.

A. P. Carman

SPECIAL ARTICLES

A NEW GENUS OF CARNIVORES FROM THE MIOCENE OF WESTERN NEBRASKA

While engaged in restudying the material described as *Amphicyon superbus* by the writer in the *Annals of the Carnegie Museum*, Vol. IV., p. 51, it has become apparent that the species, though allied to the European forms, should be regarded as generically distinct from them, and that it is more nearly related to *Daphœnus* from the Oligocene of North America. The type specimen consists of a practically complete skeleton, which has been freed from the matrix and is ready for mounting. It is now being restudied and described in detail by the present writer.

For this new genus from the Miocene formation of western Nebraska I propose the name *Daphœnodon*. The dentition and cranium show close similarity to *Daphœnus* from the Oligocene, and the latter genus apparently represents the ancestral stock from which the proposed genus *Daphœnodon* is descended.

Daphœnodon, gen. nov.

(Type *Daphœnodon superbus* (Peterson), Specimen No. 1589, Car. Mus. Catalog Vert. Foss.)

Principal Generic Characters: Cranium comparatively short, broad, and low; muzzle large, sagittal crest prominent; brain-case small; incisors heavy and short; canines comparatively small and oval in cross-section; P^4 with antero-internal cusp of moderately large size; M^1 and M^2 large and broad; M^3 present, though small, practically one-rooted and aligned with the internal border of M^1 and M^2.

Upon very careful comparison of the type specimen of *Daphœnodon superbus* with casts of *Amphicyon giganteus* (*A. major* Blainville) and also with illustrations of the best known European forms[1] it is evident that there are characters of considerable importance, which may be regarded as of generic value. The more important differences may be stated as follows:

The skull of *Amphicyon giganteus* is represented only by the left maxillary, but it indicates a cranium having considerably greater elevation from the alveolar border of the maxillary to the nasals than is the case in *Daphœnodon superbus*. It is also seen that the alveolar border is more strongly developed posteriorly in the European genus, M^3 being succeeded by a considerable process of the maxillary, while in the American genus the border back of M^3 is extremely thin.

In the European form, *A. giganteus*, the canine is of very large size, sharply pointed, has a decided cutting edge posteriorly and a prominent rib on the antero-internal angle, which causes the cross-section of the tooth to be very elliptical, as in certain cats of the Oligocene, while the corresponding tooth in *Daphœnodon superbus* is proportionally much smaller, the edges not so sharp in front and behind, and the tooth consequently having a more oval cross-section. The superior premolars in the European genus are proportionally smaller, P^4 has a distinctly smaller antero-internal tubercle and the long axis of the crown is more nearly antero-posterior, the tooth being placed less obliquely in the jaw than is the case in *Daphœnodon superbus*. The superior molars of the latter genus differ in some important particulars, viz.: M^1 is of relatively greater transverse diameter and the posterior intermediate tubercles, especially the one on M^2, which closes the posterior opening of the median pit in *Amphicyon giganteus*, are absent. M^3 of the latter genus

[1] Blainville, Vol. II., Pl. XIV.; Filhol, *Ann. Soc. Geol.*, X., pp. 77–79, Pl. 10–16, 1879.

is of greater functional importance than the corresponding tooth in the American form.

From the illustrations of *Amphicyon lemanensis* by Filhol[2] it is seen that the occipital condyles of that form are less sessile, the mastoid process is of larger size, and the tympanic bullæ were probably smaller. It is also seen (Pl. XI., figs. 4, 6–8) that M^3 has three roots and the crown is occupied by three distinct cusps, a distinctly more conservative character, and properly to be considered as more primitive than that of the reduced and comparatively simple crowned M^3 of *Daphœnodon superbus*. Another character which seems to indicate less specialization in the European genus is the short antero-posterior diameter of M_1, when compared with that of *Daphœnodon superbus*.

It is further seen on comparison that the skull of *Daphœnodon superbus* is less elongated than that of *Daphœnus felinus* from the American Oligocene. The base of the skull back of the pterygoids is especially shortened. The muzzle is heavier. The incisors are larger, the antero-internal tubercle of P^4 (carnassial) is less developed, M^1 and M^2 are more developed internally, and the postero-internal angles of M_1 and M_2 are more prominent. The position of P^4 is less oblique in the alveolar border than is the case with the corresponding tooth in *Daphœnus felinus*, a character tending toward conditions found in the recent dogs.

The limbs of *Daphœnodon superbus* are comparatively long and slender, the thoracic region rather light, and the tail is very long. These are characteristic structural features of *Daphœnus felinus* described by Mr. Hatcher in the *Memoirs of the Carnegie Museum*, Vol. I., pp. 66–95.

O. A. PETERSON

CARNEGIE MUSEUM,
March 20, 1909

NOTES ON MUSHROOM SPORES

IN making experiments to determine if the spores of dung-inhabiting mucors pass through the stomach and intestines of animals before they germinate, an interesting fact about the spores of mushrooms was discovered.

Some fresh horse manure, immediately after it was voided, was placed upon a sterilized plate and covered with a sterilized glass cover. On examining parts of this manure for mucor spores, there were found spores resembling mushroom spores. The plate was then set aside for three weeks when an abundant crop of mushrooms appeared. Examination proved them to be *Coprinus ephemerus* Fries.

There is a possibility that the spores might have been floating in the air and might have fallen upon the manure in the short time that it was exposed in the stable but it is not very probable that such was the case.

It seems practically demonstrated that these spores passed through the digestive tract of the horse and escaped any injurious effect from the process of digestion. They germinated and developed into mature plants in a very short time.

DAVID R. SUMSTINE
WESTERN UNIVERSITY OF PENNSYLVANIA,
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TANKS FOR SOIL INVESTIGATION AT CORNELL UNIVERSITY

THERE are certain experiments involving fundamental problems in soil productiveness that can be conducted only where it is possible to accurately measure the conditions as they exist in the field, and to maintain the records through a great number of years. Some of these problems are as follows:

Effects of the continuous use of large amounts of mineral fertilizers upon the physical and chemical properties of the soil, and upon the bacterial flora and bacterial activity.

Changes that occur in a series of years when soils gradually deteriorate or improve.

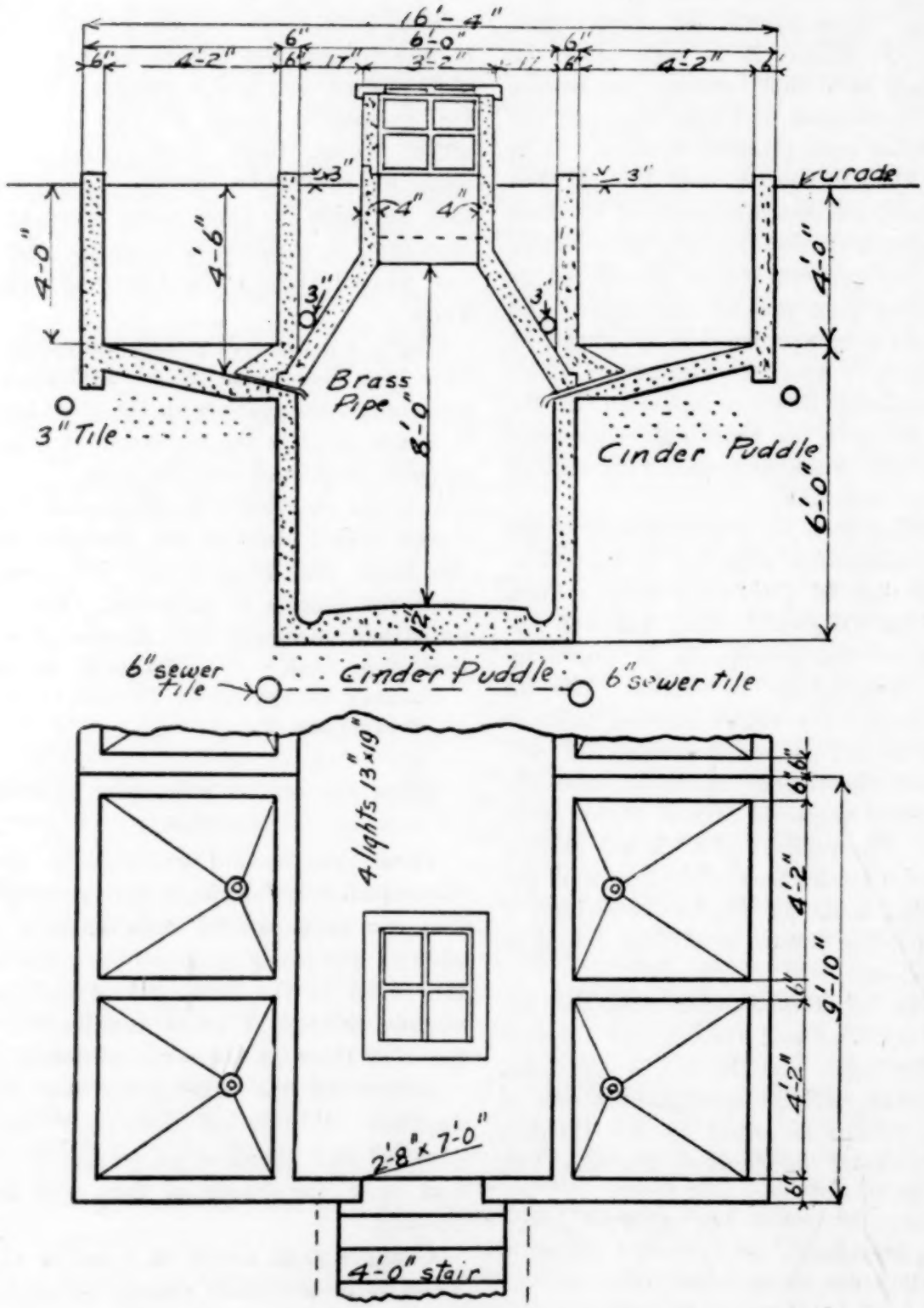
Effect of different methods of soil treatment upon the loss of lime in the drainage water.

The loss of potassium and other substances occasioned by manuring with lime.

Loss of soluble salts caused by clean cultivation.

Extent to which soils under field conditions

[2] *L. c.*, Pl. XIII., Fig. 5.



TANKS FOR
SOIL INVESTIGATION
CORNELL UNIVERSITY
Scale $\frac{1}{4}$" = 1'-0"

are renewed by accession of lower soil to the plowed portion.

For the purpose of conducting investigations of this kind there have been built on the farm at Cornell University a number of large tanks in which soil may be kept at the same surface level, and under conditions nearly identical with that of the surrounding soil, upon which duplicate tests are made. They are intended to furnish receptacles for bodies of soil of sufficient size to produce plants in a normal manner under approximately field conditions, and yet afford opportunity for measuring a large number of the factors affecting plant growth. The construction is of concrete, but the tanks will be lined.

Each tank is four feet two inches square with a maximum vertical depth of four feet six inches and a minimum depth of four feet. There are twenty-four tanks placed in two rows of twelve tanks each. Between the rows of tanks is a tunnel, the bottom of which is ten feet below the top of the tanks. The tunnel is six feet wide. From the lowest point in each tank is an outlet tube two inches in diameter and tin lined. It is made large enough to permit of easy cleaning and has no bends in it. A piston runs through the tube to within four inches of the upper end. Between the perforated head of the piston and the soil, glass wool is to be inserted. The piston can be withdrawn if it is desired to clean the tube.

Drainage water from each tank will be caught in a receptacle in the tunnel. The lining in the tanks will prevent any soluble material in the concrete from appearing in the drainage water. A constant water table at any desired depth may be maintained by raising the rubber tube leading from the outlet tube to a corresponding point below the surface of the soil in the tank.

The tanks, as described, will each contain between three and four tons of soil, and the surface will constitute approximately .0004 of an acre. They are built with special reference to durability so that it will be possible to plan for experiments to extend over a long period. The quantity of soil contained is not too large to allow of accuracy in sampling and yet is sufficiently large to closely resemble field conditions, which is not true of the quantity contained in pots. No covering is to be placed over the tanks, but in every way natural conditions are to be permitted. The top soil and subsoil will be placed in their relative positions. It is expected that the rainfall will be sufficient to meet the needs of the crops, but if the plants suffer during periods of drought they can be watered artificially.

Any desired type of soil may be used which is not possible with ordinary field experiments. It is also possible to make a comparison of different soil types under any desired condition which may be very serviceable in ascertaining the effect of those properties differentiating these types upon certain factors in soil productiveness.

The chief feature of the plan is that of keeping accurate records of the factors affecting plant growth without producing artificial conditions.

The tube leading from the bottom of the tank is designed to carry off the drainage water into a receptacle which will permit the quantity to be measured and its constituents to be determined.

The accompanying diagram shows the plan and cross-section of these tanks.

T. L. LYON

THE GEOLOGICAL SOCIETY OF AMERICA

THE twenty-first annual meeting of the Geological Society of America was held under the presidency of Professor Samuel Calvin, of Iowa City, Iowa, in the rooms of the geological department, Johns Hopkins University, Baltimore, Tuesday, Wednesday and Thursday, December 29, 30 and 31, 1908.

The first session of the meeting was called to order at ten o'clock Tuesday morning with President Calvin in the chair and the society was cordially welcomed to Baltimore by Professor W. B. Clark in a few well-chosen remarks, to which appropriate response was made by President Calvin.

The secretary, Dr. E. O. Hovey, of the American Museum of Natural History, reported that the printed list of fellows contained 294 names, the

same as at the time of making the last annual report. During the year the four new fellows elected at the Albuquerque meeting qualified; two fellows, Homer T. Fuller and William S. Yeates, were lost by death, and two by resignation. After presentation of the memorials of the deceased fellows the regular program of papers was taken up as follows:

The first paper read was:

Some Distinctions between Marine and Terrestrial Conglomerates: Joseph Barrell, New Haven, Conn.

The problem was approached by studying the effects of shore, as compared with subaerial, activities upon the production, transportation and deposition of gravel. It has been found that the truly terrestrial forces produce vastly more gravel, spread it far more widely, and provide more opportunities for deposition, than do the forces of the littoral zone. Conglomerate formations, therefore, should be dominantly of terrestrial origin. In order to determine, however, the mode of origin of particular examples, definite criteria must be drawn between the two classes. It was shown that the thickness was one of the most important of these marine conglomerates, except under local and special circumstances, being limited to considerably less than one hundred feet in thickness, terrestrial conglomerates, on the other hand, being frequently measured in hundreds and occasionally in thousands of feet.

Attention was next turned to the significance of the intercalated non-conglomeratic beds and the relations to the under- and over-lying formations, with the conclusion that the characteristics of the associated strata are frequently of high supplemental value for determining the mode of origin.

Applications of the conclusions were made to several conglomeratic formations.

Professor Barrell's paper was discussed by Messrs. G. K. Gilbert, J. Barrell and W. H. Hobbs.

The following papers were read by title:

The Chemistry of the Pre-Cambrian Rivers: Reginald A. Daly, Boston, Mass.

The Primary Origin of the Foliated Structure of the Laurentian Gneisses: Frank D. Adams and Alfred E. Barlow, Montreal, Canada.

Relations of Present Profiles and Geologic Structure in the Desert Ranges: Charles R. Keyes, Des Moines, Iowa.

Deflation and the Relative Efficiencies of Erosive Processes under Conditions of Aridity: Charles R. Keyes, Des Moines, Iowa.

Then were read:

Unconformity Separating the Coal-bearing Rocks in the Raton Field, New Mexico: Willis Thomas Lee, Washington, D. C.

The coal-bearing rocks of northern New Mexico in the vicinity of Raton occupy the southern part of the Raton Mountain region. The rock formations are the same as those of the Trinidad coal field in southern Colorado, heretofore referred to the Laramie. Recent work in the Raton field has proved that there are two coal-bearing formations separated in time by a period of erosion. The evidence of the hiatus is found: (1) in the partial removal of the older beds, (2) in the character of the pebbles found at the base of the younger formation, (3) in the affinities of the fossil plants.

Evidence that the Appalachian and Central Coal Fields were once connected across Central Kentucky: Arthur Miller, Lexington, Ky.

In support of the view long entertained, that the different Carboniferous coal fields of the United States were formerly connected, the writer during the past summer found deposits of Coal Measure conglomerate in a narrow band along the watershed between the Green and Salt rivers, and in previous years had noted it between Bacon Creek, a tributary of Nolin River, and Green River; and also on the top of King's Mountain, near the head of Green River. During most of this stretch it forms the crest of Muldrow's Hill. It consists of massive bowlders of large quartz pebble conglomerate and great banks of pebble and sand waste. It has contributed much material to the lands lying south of Muldrow's Hill, giving to many of them a sandy character. It itself, near the middle of its course, is deeply dissected, resembling in its topography, soils and population, the same formation in eastern Kentucky.

The Bearing of the Tertiary Mountain Belt upon the Origin of the Earth's Plan: Frank Bursley Taylor, Fort Wayne, Ind.

Suess showed with great clearness and force that the peripheral mountain system of Asia was formed by horizontal thrust movements from the north; *i. e.*, from the interior of the continent towards the ocean.

In the present paper the following points are dwelt upon as tending to confirm Suess's generalization and the writer's extension thereof:

1. The Tertiary mountain arcs and island festoons of Asia bulge outward towards the south, showing southward crustal creep of the continental mass.

2. The Himalaya mountain range exceeds others in height, because it was so severely pressed against the north side of the older plateau of

India. The Malay arc, lapping around the eastern end of the Himalaya and swinging far to the south—even beyond the equator—met no such obstacle. It spent itself more freely and formed the most remarkable of the great earth-lobes of Asia.

3. At its eastern end the tectonic line of the Aleutian island arc penetrates to the heart of the mountain knot of Alaska, so that westward from about the 148th meridian, west longitude, Alaska belongs structurally to Asia.

4. The Tuscarora deep, close in front of the Japan and Kurile Island arcs, and also the long, narrow deep, close in front of the Aleutian arc, mark areas probably in part elastically depressed by the weight of the adjacent more or less overthrust masses. They mark the negative side of these great tectonic lines, while the high, though largely submerged, mountain ranges of the adjacent island arcs mark the positive, uplifted side of the same lines. These troughs are now unfilled, because the uplifted ranges near them have remained largely submerged and hence have supplied little or no sediment.

5. The mountain knot of Alaska was raised to its extraordinary height by a convergence of crustal creeping movements. It is precisely in the angle where the southeastward creep of the Aleutian earth-lobe came into conflict with the southwestward creep of northern North America.

6. The peculiar rift valleys on the northern and western sides of Greenland suggest a rending and tearing away of Grant Land, Baffin Land and Labrador from Greenland, due apparently to crustal creep towards the south and southwest, Greenland remaining as the great northern horst. The import of these several facts added together is Tertiary southward crustal creep, with peripheral faulting, folding and uplifting for all the northern continents.

7. Australia's Tertiary peripheral mountain belt lies in island chains seaward from its northern and eastern coasts, indicating northward and eastward crustal creep. South America's belt is on its northern and western sides, indicating northward and westward creep. Thus, the two southern continents show in general northward creep, but with a considerable amount of deflection.

8. The Celebes and Malmahera islands show remarkable "chiragratic" mountain plans, and they are precisely in the zone of conflict between the southward crustal creep of Asia and the northward crustal creep of Australia. Borneo is in the same zone and has a similar mountain plan.

Conclusions.—The foregoing facts show crustal creep in both hemispheres from high towards low latitudes. This is not explicable by any form of contraction hypothesis, but is the normal result of a force tending to deform the lithosphere by slightly and permanently increasing its oblateness —the same in effect as if the earth's axial rotation had been slightly and permanently increased. No contraction hypothesis can account for the occurrence of this remarkable epoch of mountain making at so recent a time as the Tertiary age, unless it can provide some method of storage of mountain making forces which shall endure and continue to accumulate through several geologic ages, with occasional mountain making in moderate degree going on at the same time.

The action of such a force would cause a depression of both polar areas, resulting in crustal creep towards lower latitudes. Inevitably, one polar area would yield before the other or else in greater amount. The pole from which the first large shift of mass took place would ever after take the lead and be the more active area in crustal movement, for that first movement would slightly displace the earth's center of gravity, moving it towards the other pole, where the shift of mass was less, and this change itself would intensify the deforming forces at the first pole and diminish them at the other. Thus, the first pole, corresponding to the north pole of the earth, would progressively emerge from the sea, would suffer the greater deformation and would therefore have an excess of land or continental areas around it, while the other (south) pole would be progressively submerged, would suffer less deformation and would have a minimum of land or continental areas around it. This may explain why the north pole is girdled by land and the south pole by water.

The forces causing southward crustal creep in the northern hemisphere were strongest in high northern latitudes and diminished towards the south; and further, the area of earth-crust upon which the forces acted increased towards the south. Perhaps these two conditions, modified by the tendency to a limited number of meridional rifts due to girth expansion in the equatorial belt, explain the triangular shape of the continents—broad at the north, where a land belt almost girdles the earth, and tapering in sharp points towards the south.

Mr. Taylor's paper was discussed by Professors H. F. Reid, B. K. Emerson, J. Barrell, W. H. Hobbs, A. P. Coleman and F. B. Taylor.

The session then adjourned at 12:30 P.M.

The society convened again in two sections at

2:10 P.M. The first paper presented in the main section, under the chairmanship of President Calvin, was:

On Faults: HARRY FIELDING REID, Baltimore, Md.

This was followed by

Mass Movements in Tectonic Earthquakes: HARRY FIELDING REID, Baltimore, Md.

These papers were discussed by Professor W. H. Hobbs and H. F. Reid.

The next paper was read by title:

The Alaskan Earthquake of 1899: LAWRENCE MARTIN, Madison, Wis. (Introduced by C. K. Leith.)

The society then listened to

A Recent Landslide in a Shale Bank near Cleveland accompanied by Buckling: FRANK R. VAN HORN, Cleveland, Ohio.

The landslide in question took place at the plant of the Cleveland Brick and Clay Company, beginning Monday, August 17, 1908, at 3 P.M., and lasting until late the following day. The shale bank is about 112 feet high and consists of about 3 feet of drift, 21 feet of Cleveland shale and 88 feet of Erie Chaghn shale of the uppermost Devonian. The bank cracked along the valley for a length of 250 feet and followed weathered joint planes almost entirely. The width of the crevice varies up to 22 feet and the vertical displacement is 6 to 7 feet. The mass broken off has been estimated variously up to a million tons, but one hundred thousand tons is probably excessive. After the crevice reached its widest dimensions, the severed block settled back towards the cliff about 1 foot, producing a noticeable dip of the shale layers, at the same time the valley floor at the base of the cliff buckled up into an anticline 4 to 5 feet in the highest portion and traceable over a distance 200 feet. The buckling continued over a period of two months after the crack formed. Buckling is quite often noticed in shales along the edges of stream valleys and it is possible that such movements have been caused by similar landslides.

This paper was discussed by Professors H. P. Cushing, J. W. Spencer, G. B. Richardson, F. R. Van Horn, G. K. Gilbert and G. H. Ashley.

Then was read by title:

The Volcano Kilauea: C. H. HITCHCOCK, Honolulu, Hawaiian Islands.

After this was presented:

Mt. Pelé of Martinique and the Soufrière of St. Vincent in May and June, 1908: EDMUND OTIS HOVEY, New York, N. Y.

The paper gave the results of an expedition made to the Lesser Antilles in April to July, 1908, illustrating by means of lantern slides the progressive changes in 1902, 1903 and 1908 due to the great eruptions and the efforts of nature and man to recover from them.

The last paper of the afternoon was:

Multiple Glaciation in New York: H. L. FAIRCHILD, Rochester, N. Y.

Evidence of pre-Wisconsin glaciation in territory surrounding New York State—in Canada, Ohio, Pennsylvania, New Jersey and New England, implies a similar history for the state.

An accumulating body of fact points to at least two ice invasions. Such features are: (1) the widespread occurrence of more or less difference between the surficial and the deeper till; as shown in color, texture, composition, with sometimes a distinct surface of separation; (2) weathered glaciated surfaces and heavy glacial flutings merely scraped in places by a later abrasion; (3) old planation surfaces which though protected by Wisconsin till have lost their glaciated character; (4) probable stream channels not the product of the latest glacial drainage; (5) physiographic features of anomalous relationship.

No interglacial deposits have as yet been found.

This paper was discussed by Professor G. K. Gilbert, R. S. Tarr, F. Carney, A. Penck and A. P. Brigham.

Adjourned at 5:25 o'clock.

The society met at 8 o'clock Tuesday evening in the lecture room of the geological department to listen to the presidential address of Professor Samuel Calvin, who chose as his theme "The Latest Phase of the Pleistocene Problem in Iowa." This paper will be published in full in SCIENCE.

At the close of the address, the society and its friends adjourned to the rooms above the lecture hall and participated in a "smoker" as the guests of the geological department of the university, the function closing shortly before midnight.

Wednesday morning the society came to order in general session, President Calvin presiding, at 9:35 o'clock, and after the consideration of some matters of business listened to the reading of a letter from Hon. Gifford Pinchot, chairman of the National Conservation Commission, requesting the appointment of a committee by the Geological Society of America with which the commission might confer regarding geological subjects. It was voted to empower the president to appoint three fellows to act as a committee on conservation.

Then was presented a paper by Professor Albrecht Penck, of Berlin, who had been invited by the council to participate in the meeting. Professor Penck chose as his theme "Interglacial Epochs."

At the close of this paper the special section on correlation withdrew for the continuation of its sessions, and the general section, with President Calvin in the chair, proceeded with the main program.

The following two papers were read:

Glacial Waters West and South of the Adirondacks: H. L. FAIRCHILD, Rochester, N. Y.

As the lobes of the ice sheet melted away south of the Adirondacks, high-level waters were held in the Schoharie and Mohawk valleys, into which was poured the land and glacial drainage of the time, with consequent elevated deltas. The Schoharie Lake had outlets to the Hudson and the Delaware; and subsequently the Mohawk waters overflowed southwestward to the Susquehanna, but finally to the Hudson.

The earliest outlet of the Mohawk Valley waters seems to have been by the col at the head of the Otsego-Susquehanna valley, with elevation somewhat under 1,400 feet. A lower escape was found by the Unadilla Valley, at about 1,220 feet, and possibly by the Chenango Valley at 1,150 feet. Later the outflow was eastward to the Hudson by Delanson and Altamont and past the face of the Helderberg scarp, at 840 feet as the lowest. The latest flow of the ice-impounded Mohawk waters was south of Amsterdam and past the face of the scarp at Rotterdam.

The copious drainage of the western slopes of the Adirondacks poured into a lake held in the valley of Black River, with the production of a remarkable expanse of sand plains. In the various features and relations which characterize a glacial lake the Black Lake is probably the finest example of a glacial lake in the state (though not nearly so remarkable in complexity of drainage and history as the Genesee waters). The earliest outflow of the differentiated waters of the Black Valley was southward past Remsen into the Mohawk Lake, with delta built at Trenton and Trenton Falls. The second escape was southwestward, at Boonville, into the inferior Mohawk Lake, with delta north of Rome. The third stage had westward outflow, curving around the high ground between the Black Valley and the Ontario basin, at Copenhagen and Champion, the flood pouring into Lake Iroquois at Adams.

Correlation of the Hudsonian and the Ontarian Glacier Lobes: H. L. FAIRCHILD, Rochester, N. Y.

In the waning of the Labradorian ice body the Adirondack massif became uncovered, at first as an island, with probable westward flow of the ice through the Mohawk depression. Later the glacial flow was divided into a Champlain-Hudson lobe and a St. Lawrence-Ontario lobe. For a long time the Hudsonian lobe pushed an ice tongue westward into the lower Mohawk valley, while the Ontarian lobe sent one eastward into the upper Mohawk valley. Imprisoned between the two opposing ice fronts the glacial waters stood at high levels in the Mohawk and Schoharie valleys. As the waning ice margins released successively lower passes to southern drainage the waters fell accordingly.

The delta sand plains on the flanks of the Adirondacks and in the upper Mohawk valley, with their various declining altitudes, show the successive levels of the waters; and these levels were determined by the positions of the ice margins with reference to a few critical cols or passes on the divide.

These two papers were discussed by Professors A. P. Brigham, H. L. Fairchild and A. W. Grabau.

The next paper was read by title. It was:

Pleistocene Features in Northern New York: H. L. FAIRCHILD, Rochester, N. Y.

Then the society listened to:

Pleistocene Geology of the Southwestern Slope of the Adirondacks: W. J. MILLER, Clinton, N. Y. (Introduced by W. B. Clark.)

The area discussed in the paper is about sixty miles long and fifteen miles wide and extends from Lowville to Dolgeville, N. Y. Certain evidence clearly indicates an early southeasterly movement of the ice, while other evidence shows a later, more general southwesterly direction of flows. The Black River Valley has been considerably deepened and modified by ice erosion. A distinct kame-morainic belt has been traced the whole length of the area. Associated with this moraine are so-called "sand plains," whose origin is discussed. Extinct glacial lakes are shown by the presence of considerable areas of stratified clay. The pre- and post-glacial drainage of the region and the origin of the "gulfs" were discussed.

The paper was discussed by Professor G. K. Gilbert.

Then was read:

Weathering and Erosion as Time Measures: Frank Leverett, Ann Arbor, Michigan.

The paper aimed to set forth the use that may be made of weathering and erosion in determining relative age of the several drift sheets. It also dealt with the most important qualifying conditions that affect estimates.

At the close of the reading of this paper, at 12:30 o'clock, adjournment was taken, discussion being postponed to the afternoon.

The society convened again at 2 o'clock, President Calvin presiding, and took up the discussion of Mr. Leverett's paper, the participants being Professors A. Penck, S. Calvin, F. Leverett, G. F. Wright and G. K. Gilbert.

The next two papers were then read:

The Glacial Phenomena of Southeastern Wisconsin: Wm. C. Alden, Washington, D. C. (Introduced by T. C. Chamberlin.)

A graphic presentation by a map 9 × 10 feet, scale one mile per inch, of a detailed study of the deposits of the Green Bay and Lake Michigan glaciers and associated phenomena of late Wisconsin glaciation of southeastern Wisconsin. The map covers an area approximately 8,600 square miles, which has been under study by the author under the direction of Dr. T. C. Chamberlin, during the greater part of the last ten years. The presentation comprised such description as the time permitted of the conditions affecting the advance of the two glaciers, their relations to each other, the character, distribution and mode of formation of the several deposits, terminal and recessional moraines, outwash deposits, ground moraines, drumlins and eskers, the lithological composition of the drift and its significance. Evidence was presented by a deposit of red till of a later readvance of the two glaciers southward to the vicinities of Milwaukee and Fond du Lac. The shore lines and deposits of Lake Chicago and succeeding glacial lakes were also shown.

Concerning certain Criteria for Discrimination of the Age of Glacial Drift Sheets as Modified by Topographic Situation and Drainage Relations: Wm. C. Alden, Washington, D. C. (Introduced by T. C. Chamberlin.)

The discussion was confined to phases illustrated by the pre-Wisconsin drift of southern Wisconsin and northern Illinois.

Character of this drift and reasons for regarding the drift exposed at the surface throughout this area as belonging to one and the same sheet. The lithological composition and its significance, directions of ice movement, absence of intercalated weathered zones, soils or vegetable deposits.

Differences in the apparent amount of surface modification of this drift in different parts of the area which might be regarded as indicating differences in age:

1. Topographic relations and amount of erosion.

2. Weathering, leaching and oxidation. The occurrence in places of thoroughly disintegrated drift or residual till; in others, of drift but moderately leached and oxidized; in others, of perfectly fresh unmodified drift at the surface or immediately below the loess.

The reasons for these differences:

1. Influence of pre-Glacial topography on drainage slope and upland of the drift. Influence of the St. Peter sandstone on the pre-Glacial topography. Relations of surface wash to the apparent amount of surficial leaching and oxidation.

2. The post-Illinoian diversion of Rock River below Rockford, Illinois, and the consequent retardation of erosion due to the work of cutting new rock gorges at several cols. Removal of the weathered drift from slopes with preservation on the uplands.

Necessity for caution in the discrimination of distant drift sheets in the absence of marked differences in lithological composition or of sections showing overlapping drift with intercalated soils, vegetable deposits or weathered zones.

The two papers together were discussed by F. Leverett.

Then was read:

Lake Ojibwa, the Last of the Great Glacial Lakes: A. P. Coleman, Toronto, Canada.

As the Labrador ice sheet retreated north to the watershed between the Great Lakes and James Bay, the waters now flowing northward were impounded, first as a narrow bay of Lake Algonquin opening south past Sudbury, afterwards as a separate lake with an outlet down the Ottawa Valley. This lake probably existed during the time of the Nipissing Great Lakes, and was the last of the ice-dammed lakes. The elevation of its outlet is now 900 feet, but was then much lower. In its bed the "clay belt" of northern Ontario and Quebec was deposited, having an extent of over 25,000 square miles. The maximum area covered by its waters must have been greater than that of Lake Superior; though probably its extent varied greatly in accordance with the position of the ice front.

This paper was discussed by Mr. F. B. Taylor and Professor A. P. Coleman.

The next paper was:

Glacial Erosion on Kelley's Island, Ohio: FRANK CARNEY, Granville, O.

Last summer a rectangular area about 100 rods long and 4 rods wide was stripped to open a new quarry. This area is transverse to the direction of ice-motion; its southern part does not show the slightest evidence of rasping by stone-shod ice. This rough unglaciated surface ends abruptly in a perfectly smooth, scored area which continues about 800 feet, where it again borders limestone bearing no marks whatever of ice-work. The erosion features thus revealed are so in contrast with the long-known glaciated surfaces near by that the case deserves special consideration.

The paper was discussed by Professor G. F. Wright.

Then was read:

The Chalk Formations of Northeast Texas: C. H. GORDON, Knoxville, Tennessee.

Extending in a west to east direction across the southern part of Lamar County and thence northeast through Red River County to Red River and having a width of from one to three miles, is a belt of chalk known as the Annona chalk from the town in Red River County near which it outcrops. In the earlier publications relating to the Cretaceous of Texas, this formation was considered as the diminished representative of the Austin chalk of central Texas. Later authors, however, have contended that it represents a higher horizon and belongs within the so-called Navarro division of the Upper Cretaceous.

Recent investigations by the author, in connection with the study of the underground waters of northeastern Texas, tend to confirm the earlier view as advanced by Taff that the Annona is the northeastward extension of the Austin formation. Tracing the outcrop of the Annona westward it was found to merge with that of the Austin as exposed in the vicinity of Honey Grove and westward to Sherman. At Austin the formation has a reported thickness of about six hundred feet and is composed essentially of chalk throughout. Toward the northeast the lower beds become marly, the thickness of the chalk marl increasing until in the vicinity of Red River the marls have a thickness of about four hundred feet. To this part of the formation, as represented in northeastern Texas and southwestern Arkansas, Hill applied the name Brownstown beds.

The relations seem to indicate that at the beginning of the Austin epoch the conditions for the formation of pure chalk existed only in the region about Austin, but with the progress of time they were extended farther and farther northeast as a result possibly of a change in the relative position of land and sea.

The next paper was read by title:

Geologic History of the Ouachita Region: E. O. ULRICH, Washington, D. C.

After which was read:

Some Results of an Investigation of the Coastal Plain Formations of the Area between Massachusetts and North Carolina: WM. BULLOCK CLARK, Baltimore, Md.

The author has under his supervision for the U. S. Geological Survey the investigation and correlation of the coastal plain formations occupying the territory between Massachusetts and North Carolina, inclusive, and has had associated with him in his work a number of co-workers. Some preliminary results of significance have been secured and the formations already studied in detail in New Jersey, Delaware and Maryland have been traced beyond the borders of those regions. The extension of certain of these formations southward through Virginia and North Carolina and the recognition of new members of the coastal plain series have materially added to our knowledge of coastal plain geology. Some of the more significant results of this work were presented.

This paper was followed by the reading of:

The Geologic Relations of the Cretaceous Floras of Virginia and North Carolina: EDWARD W. BERRY, Baltimore, Md. (Introduced by Wm. B. Clark.)

The evidence of the fossil plants concerning the geologic segregation and correlation of the Cretaceous of the Middle Atlantic Slope was presented by the author. Floras similar to those of the adjoining region to the northward have been found at many localities, indicating the extension to the southward of a number of the formations.

The special section on correlation having adjourned, the society then listened in general session to the following papers:

Paleogeography of North America: CHARLES SCHUCHERT, New Haven, Conn.

The ancient geography of North America, beginning with the Cambrian, was discussed and illustrated by from forty to fifty maps of as many different times. These maps give the probable extent of the marine inundations over the North American continent, and show the extent of the faunal provinces.

The diastrophism indicated by these maps is plotted on a time-geographic curve to show the

extent and duration of the periodic submergences and emergences.

The paper was discussed by Mr. B. Willis.

Revision of the Paleozoic Systems in North America: E. O. Ulrich, Washington, D. C.

Following a brief statement of current and earlier classifications of the Paleozoic rocks and of the evidence, almost solely paleontologic, upon which the present classification is founded, a new grouping of the formations was suggested. The proposed classification is based primarily on crustal movements, diastrophism, the succession of which is determined by the faunal evidence. The occurrence of such movements is determined, aside from plain physical evidence, primarily by mutations in the faunas, especially by the introduction of new faunal elements and facies, and their relative importance by (1) the extent and direction of the submergences and emergences of landmasses induced by the movements and (2) the degree of the corresponding faunal mutations. In determining the boundaries of the various kinds of units, formations, groups, series and systems, the *introduction* of the new faunal elements is insisted on as an essential factor, second in importance only to positive evidence of crustal movements, in producing a scheme of classification having the desirable features of (1) simplicity of arrangement and expression, (2) sharp definition of the major groups, (3) approximate coordination in time values of the various classes of units, (4) a high degree of accuracy in correlation of geographically separated stratigraphic units and (5) the elimination of such hybrid terms as Cambro-Ordovician and Devono-Mississippian. An attempt was made to express the extent and direction of submergences and emergences graphically by a series of curves which it is believed show an appreciable rhythm in occurrence. Considering that the evolution of the scheme involves the determination of the essential contemporaneity of many hitherto not satisfactorily related geologic events, some time was devoted to the discussion of such of the principles of correlation as have been proved by field experience to have the greatest practical value.

Among the changes proposed, the most important is a new system, the Ozarkian, comprising a number of long-misunderstood formations, typically represented in southeastern Missouri and northern Arkansas, but found also in the Appalachian Valley from New York to Alabama, in the upper Mississippi Valley, in Oklahoma, central Texas and elsewhere. Both the upper and lower boundaries of the Ozarkian are defined by more or less marked unconformities. Often the base is in contact with Acadian Cambrian, but at other localities a series of beds or formations, commonly referred to as "upper Cambrian," intervenes.

The top is succeeded by one or another of a great range of formations. In the most complete sections the next strata are of Beekmantown age, in others, however, the succeeding bed is much younger. Concerning the fauna of the Ozarkian, it is to be said that the trilobites and brachiopods, though all new, remind one strongly of preceding Cambrian types. The other classes, among them a host of gastropods and cephalopods, are quite different and on the whole closely allied to Ordovician genera and species.

Suggested changes of comparatively minor import were (1) the correlation of the Richmond with the Medina and, hence, the removal of that group to the Silurian; (2) the restriction of the Devonian to the lower and middle Devonian of current classifications and the transfer of the upper Devonian to the next younger system; finally (3) it was argued that the Meramec and Chester groups of the present Mississippian constitute another system coordinate in value to the Silurian and Devonian.

Mr. Ulrich's paper was interrupted by adjournment at 5:45 P.M. and the reading was finished on Thursday. It was discussed by Professor A. W. Grabau.

At 7 o'clock Wednesday evening the fellows and their friends, to the number of 133, gathered at the Hotel Rennert and sat down together at the annual dinner of the society. President Calvin presided, and, after dinner, remarks were made by him and Messrs. Gilbert, Penck, W. B. Clark, G. O. Smith, Brock, Chamberlin, Hovey, Gulliver, Van Hise, Emerson and Stevenson.

The society convened again at 9:45 o'clock Thursday morning, President Calvin being chairman, and after hearing sundry announcements by the secretary listened to the reading by the secretary of the following report from Professor T. A. Jaggar, Jr., chairman of the committee on earthquake and volcano observations:

"Acknowledgments have been received from the governors of the Leeward Islands, of Hawaii, of Jamaica and of St. Thomas, from the chairman of the Isthmian Canal Commission and from the secretaries of the Smithsonian Institution and of the committee on seismology of the American Association for the Advancement of Science.

"Hon. W. F. Frear, governor of the Hawaiian Islands, writes:

"'Hawaii is an important point for observations of this kind, but how much can be done in this direction is a question. I shall be glad to give what encouragement I can in this matter. The federal government now has a magnetic observatory here, which also contains a seismograph.'

"Wm. Johnstone, Esq., colonial secretary of Jamaica, writes:

"'In reply I am to state for the information of the society that the Weather Service of Jamaica has already in use two seismometers in this island, one at Kingston and one at Chapelton, about the center of the island, and that there are now being constructed here about a dozen seismometers on an improved principle.'

"Col. Geo. W. Goethals, chairman and chief engineer of the Isthmian Canal Commission, writes:

"'We have now at Ancon, Canal Zone, an observatory equipped with a complete assortment of modern, self-recording meteorological instruments, *i. e.*, barograph, air and water thermograph, hydrograph, baragraph à poid, triple register (wind direction and velocity, rainfall and sunshine) and the standard instruments necessary properly to correct their records. We expect shortly to erect two horizontal pendulum Bosch-Omori seismographs—one a hundred-kilogram pendulum instrument (tromometer), which will enable us to obtain registered records on smoked paper of all movements of a telluric nature, either seismic or otherwise, near or distant, and also the variations of the vertical line. The magnification is 100, and the period of oscillation of the tromometer can be extended to forty seconds. Attached to this instrument is an air-damping apparatus, by which the oscillations may be reduced, or even rendered aperiodical. Owing to its sensitiveness, this instrument is well adapted to the registration of earth tremors, pulsatory oscillations, and comparatively quick period earthquake vibrations.

"'The proposed new equipment, therefore, will be such as to enable us to make observations in connection with earthquakes, whether of a tectonic nature, or produced by volcanic action, as well as of other physical phenomena, such as earth tremors and pulsations, which may, as premonitory signs, have a bearing on the prediction of earthquakes. We are also prepared to study the relations that may exist between seismic disturbances, pressure and temperature.

"'While we can not make our studies cover the entire field of seismology, we believe our observations will be of considerable utility in the work that the Geological Society of America has undertaken.'

"The chairman of your committee has to report for his own district that, through the efforts of Professor J. B. Woodworth, Harvard University has installed a seismograph which is in active operation, and that money has been given by citizens of Boston whereby another Bosch-Omori instrument has been secured, and plans and drawings are now under consideration with a view to the building of a geophysical observatory near Boston which will be under the direction of the department of geology of the Massachusetts Institute of Technology."

The secretary reported from the council the constitution of W. B. Clark, H. E. Gregory, C. W. Hayes, J. M. Clarke and E. O. Hovey a committee to confer as to details with a committee of organization which had been chosen by certain paleontologists desiring to form a Paleontological Society as a section of and in close affiliation with the Geological Society of America, the council heartily commending the project. On motion the action of the council was endorsed and the committee given authority to act for the society.

The society then divided into two sections, as on Wednesday afternoon, and the following papers were presented under the chairmanship of President Calvin:

A Classification of Crystals based upon Seven Fundamental Types of Symmetry: CHARLES K. SWARTZ, Baltimore, Md.

A new and elementary development of the 32 groups of crystals was given, showing that all crystals fall into seven fundamental divisions based upon symmetry which are independent of the seven systems of crystals. Each of these types was characterized and a classification of crystals upon this basis was proposed. It is believed that the recognition of these divisions greatly simplifies the presentation of the subject of crystallography.

This paper was discussed by Professors W. H. Hobbs, E. H. Kraus, W. N. Rice and H. B. Patton.

The following paper was presented by title:

The Use of "Ophitic" and Related Terms in Petrography: ALEXANDER N. WINCHELL, Madison, Wis.

Then was read:

Chemical Composition as a Criterion in Identifying Metamorphosed Sediments: EDSON S. BASTIN, Washington, D. C. (Introduced by G. O. Smith.)

This paper called attention to the small number of definite statements, even of a qualitative char-

acter, in geological literature, as to the nature and value of chemical criteria in distinguishing schists of sedimentary from those of igneous origin. Quantitative statements are wholly wanting.

By compiling a large number of analyses of pelitic sediments the writer showed the nature of the chemical changes involved in their metamorphism. He then proceeded to contrast the composition of the pelitic schists and gneisses with that of their allies among igneous rocks. The calculation of the "norm" of a schist and its classification according to the quantitative system of Cross, Iddings, Pirsson and Washington was pointed out as a convenient method for making such comparisons.

These statistical studies brought out not only the character of the chemical criteria which may be used, but gave a quantitative measure of their value. The paper concluded with the application of these criteria to certain selected schist and gneiss analyses.

The discussion on this paper was participated in by Professors B. K. Emerson, W. S. Bayley, F. D. Adams and E. S. Bastin.

After this the following paper was read by title:

Petrology of the South Carolina Granites (Quartz Monzonites): Thomas Leonard Watson, Charlottesville, Va.

The next two papers, being on related topics, were presented in succession:

Tertiary Drainage Problems of Eastern North America: Amadeus W. Grabau, New York City.

The Laurentian River of Spencer carried the collected drainage of the Great Lakes through Ontario Valley and out by the way of the present St. Lawrence. The Finger Lake valleys and the Genesee are regarded as made by tributary northward flowing streams. Fairchild regards these as northward-flowing tributaries of a (possibly) westward-flowing river in the Ontario Valley. The author has in the past shown that a normal sequential drainage system, the general direction of which was northward, and in which the minor streams were beheaded by the master, accounted for all the topographic features of the region in question. Subsequent blocking of some of the channels by drift and deepening of others by ice, and a general depression of the country to the northeast, has produced the present drainage system. The problems were discussed in the light of accumulated facts.

Drainage Evolution in Central New York: H. L. Fairchild, Rochester, N. Y.

The paper aimed to assist in the elucidation of the complete physiography of the west half of New York State. Three maps represented graphically the general evolution of the drainage and the interference by glacier invasion of the normal stream development.

The first map showed the existing valleys which are an inheritance from the primitive (consequent) drainage, southwestward, across the uplifting coastal plain. These inherited valleys fall into three classes: (*a*) those in which the present flow is the same as the primitive, (*b*) those which are abandoned or left as "hanging" valleys and (*c*) those in which the stream flow has been reversed. A remarkable parallelism is exhibited by these valleys, which, except in the district of the Delaware and upper Susquehanna, are transverse to the present master streams. The primitive Susquehanna continued directly south at Lanesboro, instead of bending northwest as now, and occupied in Pennsylvania the Tunkannock Valley. Other valleys in northern Pennsylvania represent the continuation of the southwestward flow in central New York.

The second map exhibited the hypothetical Tertiary drainage. During Mesozoic and Tertiary time all the drainage of the west half of the state was diverted westward (subsequent) and northward (obsequent) into a great trunk stream that occupied the Ontario and Erie valleys and probably drained westward into the Mississippi basin. The cause of this radical reversion of flow was the great thickness of non-resistant rocks in the Ontario district. In the vertical series of strata between the Trenton and the Portage, on the Cayuga meridian, are 5,150 feet of rock of which 4,500 feet are weak shales, 350 feet limestone and 250 feet sandstone.

The pre-Glacial divide was far south in Pennsylvania. The Allegheny system poured north through the lower Cattaraugus Valley. The upper Genesee was tributary to the broad Dansville-Avon River, which almost certainly had its northward course through the Irondequoit Valley. The Susquehanna turned west from the site of Lanesboro and Susquehanna villages along the strike of the Chemung strata, which were less resistant than the overlying Catskill, past the sites of Binghamton, Owego and Waverly, and then curved north through the sites of Elmira and Horseheads and occupied the Seneca Valley. The Chemung was the principal tributary from the west, as to-day, but it passed north of Elmira instead of south, where it now lies in a post-Glacial cut.

The Delaware and the upper tributaries of the

Susquehanna were not diverted from their southwest courses.

Along the Ontario lowland the Tertiary channels are almost entirely destroyed or obscured by drift, but the valleys of Irondequoit, Sodus, Little Sodus and Fairhaven are trenches across the Niagara-Medina scarp which probably represent the northward pre-Glacial flow. To-day only two large streams pass across this rock ridge, the Genesee and Oswego, both in new channels. It seems probable that along the belt of Salina outcrop the pre-Glacial tributary streams flowed east or west as they do to-day.

It was suggested that the "oversteepened" walls of the bottom sections of the Finger Lakes valleys were produced by the rapid down-cutting of the streams during the Tertiary uplift.

The third map showed the principal stream flow as compelled by the ice sheets. A few strong south-leading valleys were enlarged or newly cut by the concentrated glacial waters, and the Allegheny and Susquehanna systems were turned to the south. In order from west to east the glacially developed valleys are Cassedaga, Conewango, Ischua, Canisteo, Cohocton, Cayuta, Cattatonk, Tioughnioga. These southeastward drainage lines, transverse to the primitive flow, were carved from numerous, short, subsequent valleys by stream flow forced to the southward by the ice-damming. Such flow was effective during the advance of the ice sheet, but stronger during the waning of the ice; and probably more than one ice invasion has been concerned.

On the Ontario lowland the forced drainage was west or east, alongside the ice margin. In the Erie basin the later flow was all westward past the ice front. In the Mohawk Valley the drainage between Little Falls and Rome was turned from west to east.

The water-parting which in pre-Glacial time lay in Pennsylvania has been so changed by glacial flow that it now lies close to the Finger Lakes.

These papers were discussed together by Professors A. W. Grabau, J. W. Spencer, F. Carney, A. P. Brigham, G. F. Wright, F. B. Taylor, A. P. Coleman and H. L. Fairchild.

At 12:40 o'clock the society adjourned for luncheon, meeting again at 2:05 o'clock to continue the reading of papers. President Calvin occupied the chair. The first two papers were read by title. They were:

Some Physiographic Features of the Shawangunk Mountains: GEORGE BURBANK SHATTUCK, Poughkeepsie, N. Y.

Nantucket Shorelines, III.: F. P. GULLIVER, Norwich, Conn.

Then was presented:

Nantucket Shorelines, IV.: F. P. GULLIVER, Norwich, Conn.

The writer has not been able to continue as fully as would have been desirable the detailed study of the island of Nantucket and its changing shoreline, on account of the cost of oft-repeated observation and survey. Some results of further study since the last report made to the society were given.

The strong north and northeast storms of the past fall have closed the Haulover, and the tombolo from Wauwinet to Coskata was completed on November 12, 1908. Some old maps have been studied with reference to the former eastward extension of the oldland at Wauwinet, Coskata and Folger islands. The changes on Great Point since 1896 were compared with previous conditions and with what may be expected in future. The shoals between Nantucket and Cape Cod, and between Nantucket and Martha's Vineyard and the Hyannis shore are considered as attempts of the sea to build tombolos.

After this was presented:

Note on Striations, U-shaped Valleys and Hanging Valleys produced by other than Glacial Action: EDMUND OTIS HOVEY, New York City.

The volcanic sand-blasts due to the eruption of Mt. Pelé produced striations and grooves in the material over which they passed that strongly resemble the striations and grooves produced by ice action. The heavily burdened streams of the Soufrière of St. Vincent have carved out rock channels of typical U-shape in the old lava flows of the volcano. Hanging valleys have been produced by the sea eroding more rapidly than the streams.

The paper was discussed by Professor A. Penck.

Then was read by title:

Historical Notes on Early State Surveys: GEORGE P. MERRILL, Washington, D. C.

The next paper was:

The Iron Ores of Maryland: JOSEPH T. SINGEWALD, JR., Baltimore, Md. (Introduced by W. B. Clark.)

This paper presented a brief summary of the results of an investigation carried on during the past season on the iron ores of Maryland under the auspices of the Maryland Geological Survey. Four classes of ore were recognized—limonite, hematite, magnetite and siderite. The paper presented embraced a discussion of the character and

chemical composition of each of these ores, the localities in which the deposits occur, and also their geologic and stratigraphic relations.

After this was presented:

The Shortage of Coal in the Northern Appalachian Field: I. C. White, Morgantown, W. Va.

The next paper was read by title:

Glacial Character of the Yosemite Valley: François Matthes, Baltimore, Md. (Introduced by Wm. Bullock Clark.)

Then was presented:

The Mills Moraine with some discussion of the Glacial Drainage of the Longs Peak (Colorado) District: Edward Orton, Jr., Columbus, Ohio. (Introduced by F. P. Gulliver.)

This paper was discussed by Mr. W. T. Lee.

The next paper read was:

Quartz as a Geologic Thermometer: Fred E. Wright and E. S. Larsen, Washington, D. C.

Observations by Le Chatelier and Mallard in 1889–1890 proved that at about 570° quartz crystals undergo a reversible change, the expansion-coefficient, birefringence and circular polarization all changing abruptly. O. Mügge (*Neues Jahrbuch, Festband*, 1907, 181–196) has recently considered the problem again in detail and by means of etch figures combined with crystallographic behavior on heating found that below the inversion point quartz crystallizes in the trapezohedral-tetartohedral division of the hexagonal system, while above 570° it is trapezohedral-hemihedral. The high form is very similar to the low form and differs chiefly in the fact of its common planes of symmetry. A plate formed above 570° is trapezohedral-hemihedral, but on cooling it changes to the trapezohedral tetartohedral division, thereby losing its common planes of symmetry, which may then become twinning planes. It is to be expected, therefore, that quartz crystals thus cooled will be irregularly and intricately twinned after (1010.), while low temperature quartzes are simple or regularly twinned. It is furthermore evident, on considering the genesis of quartz at different temperatures, that intergrowths of right- and left-handed quartz are limited chiefly to quartz crystals formed below 570°. These two criteria can be used to distinguish quartz which has been formed or heated above 570° from quartz which has never reached that temperature. The object of the present investigation has been to test the general validity of the theoretical conclusions on a number of quartzes from different kinds of rocks and veins, as well as to determine more accurately the inversion temperature.

SECTIONAL MEETING FOR PAPERS ON STRATIGRAPHIC, AREAL AND PALEONTOLOGIC GEOLOGY

The section was called to order at 10 o'clock Thursday morning by Professor W. B. Clark, who was then elected presiding officer. Professor E. R. Cumings acted as secretary throughout, by request of the secretary of the society.

The first paper read was:

Occurrence of the Magothy Formation on the Atlantic Islands: Arthur Barneveld Bibbins, Baltimore, Md.

The Magothy formation (of mid-Cretaceous age), as originally defined by Darton, was supposed by that author to be limited to the state of Maryland, although its partial equivalent, the "alternate clay-sands," was earlier mentioned by Uhler as occurring much farther northward. Recent investigations, paleobotanical and stratigraphic, by Hollick, Berry and the writer have extended the lines of the formation far southward, and northward across New Jersey and along the Atlantic Islands as far as Marthas Vineyard. The occurrence upon these islands was shown by local sections and photographs. The deposits are richly plant bearing, with grains of amber associated, as on the Magothy River. The formation suffered considerable corrugation by the great ice sheet.

The paper was discussed by Dr. David White and Professor A. B. Bibbins.

The next paper presented was:

Erosion Intervals in the Tertiary of North Carolina and Virginia and their bearing upon the Distribution of the Formations: Benjamin L. Miller, South Bethlehem.

Recent investigations have furnished evidence of several uplifts and subsidences during Tertiary time in North Carolina and Virginia that have determined the present distribution of the formations. These have affected large areas at certain periods but at other times have been localized.

Then followed:

The Character and Structural Relations of the Limestones of the Piedmont in Maryland and Virginia: Edward B. Mathews and J. S. Grasty, Baltimore, Md., and Charlottesville, Va.

A study of the small bodies of crystalline limestones and marbles found along the western edge of the Piedmont from Pennsylvania to North Carolina shows that their occurrences mark the tops of tightly compressed anticlines. The deposits on either side are usually metamorphosed volcanics—flows and tuffs—which in the normal

section lie far beneath the limestones. The areal distribution, contacts and structural lines point to a strong overthrust fault of wide extent.

This paper was discussed by Professor J. Barrell.

After this was read:

Recurrence of the Tropidoleptus Fauna and the Geographic Range of Certain Species in the Chemung of Maryland: CHARLES K. SWARTZ, Baltimore, Md.

The recurrence of *Tropidoleptus* and associated species of Hamilton type above the base of the Chemung of Maryland was noted. Certain diagnostic species of the Chemung, particularly those of the genera *Douvillina* and *Dalmanella*, appear to be of rare occurrence east of the Allegheny Front. The significance of this fact was discussed.

Discussion of the foregoing paper was participated in by Professors H. S. Williams, H. F. Cleland, Charles Schuchert, C. K. Swartz, J. M. Clarke, Stuart Weller, E. R. Cumings and C. S. Prosser.

Then was read:

The Geological Distribution of the Mesozoic and Cenozoic Echinodermata of the United States: WM. BULLOCK CLARK and M. W. TWITCHELL, Baltimore, Md., and Columbia, S. C.

The authors presented the results of an investigation of the Mesozoic and Cenozoic echinodermata of the United States, particularly in reference to the geological distribution of the forms studied. Representatives of the echinodermata are found at most horizons, but are numerous and significant in the Cenozoic and Tertiary rocks, where they at times become important forms for the determination of geologic horizons. The Upper Cretaceous formations both of the Atlantic and Gulf states have afforded a large number of important species.

The paper was discussed by Dr. J. M. Clarke and Professor W. B. Clark.

The next paper read was:

On the Age of the Gaspé Sandstone: HENRY S. WILLIAMS, Ithaca, N. Y.

A review of the evidences upon which has been based the opinion that the marine fauna at the base of the Gaspé sandstone is of the Hamiltonian epoch, and a presentation of the evidence for the view that these marine beds, as well as those of Pictou iron ore beds of Nova Scotia, Moose River sandstone of Maine and the upper beds of the St. Helen's Island conglomerate and of Côte St. Paul, are not of later age than the Oriskany beds immediately underlying the Onondaga limestone of North Cayuga, Ontario or Schoharie grit of eastern New York, at which epoch it is inferred marine connection with the Atlantic basin was cut off.

The Owl's Head and Chaudière River beds were explained by supposing the opening of a channel westward, connecting with Indiana basin and southwest at beginning of the succeeding Onondaga epoch.

The paper was discussed by Professors J. M. Clarke, Charles Schuchert, H. S. Williams and A. W. Grabau.

The section adjourned at 12:30 P.M. and met again at 2:15 P.M. with Professor W. B. Clark in the chair.

The following two papers were read by title:

The Aftonian Sands and Gravels in Western Iowa: BOHUMIL SHIMEK, Iowa City, Iowa.

An Aftonian Mammalian Fauna: SAMUEL CALVIN, Iowa City, Iowa.

Then was presented:

The Brachiopoda of the Richmond Group: AUGUST F. FOERSTE, Dayton, Ohio.

In the area dominated by the Cincinnati geanticline there have been several invasions of the brachiopoda considered most typical of the Richmond group. The first of these occurred near the middle of the deposition of the Arnheim bed. The Richmond group of the Mississippi Valley, as far as may be determined from a study of the brachiopoda, finds nearer representatives in the upper or Blanchester division of the Waynesville bed and in the Liberty bed, than in the Arnheim, lower Waynesville or Whitewater beds. A study of the distribution of the brachiopoda in Ohio, Indiana and Kentucky suggests that the centers of distribution lay more frequently toward the northeast than toward the northwest or west of the present areas of exposure. To account for this it is imagined that the Richmond group of the Ohio Valley was connected with that of the Mississippi Valley by way of northern Indiana and Illinois. Possibly, if the areas now covered by overlying formations could be exposed, the Richmond brachiopoda would be found to be absent in southern Indiana and Illinois and in western Kentucky, west of the present areas of exposure of these fossils in the region of the Cincinnati geanticline. Lithological conditions within the areas dominated by this geanticline favor this view.

Professor E. R. Cumings discussed this paper.

After this, the following paper was read:

The Trap Sheets of the Lake Nipigon Basin: ALFRED W. G. WILSON, Montreal, Canada.

The well-known trap sheets which form one of the most salient geologic features of the north shore of Lake Superior, are usually regarded as intrusive in origin and of the nature of laccolitic sills. In the basin of Lake Nipigon, lying north of Lake Superior, on the Laurentian peneplain, the trap sheets are found to rest either directly upon the Archean rocks or upon small outliers of the sediments, often many miles distant from the main areas of similar age. The traps are known to rest unconformably upon at least five different earlier formations. This unconformity can be explained by attributing to the fluid traps the ability to insinuate themselves, in an extremely intricate manner and over a very large area, between overlying sediments and underlying crystallines, here and there masses of the sediments remaining so firmly attached to the bed on which they rested that the traps flowed over and around them, cutting across the beds.

While many of the trap sheets along the north shore of Lake Superior are undoubtedly laccolitic sills, still the writer is inclined to believe that the balance of evidence shows that these sills are confined largely to the areas underlain by sediments of later date than the Archean. A simpler explanation, and one that appeals to the writer as more reasonable, of the relations known to exist between these trap sheets and the underlying rocks in the Nipigon basin, is that, at least along the line of the escarpments which mark the boundary between the sediments and the Archean areas to the north and out upon the old land itself, the same traps flowed over an eroded surface of subaerial origin.

Incidentally there is strong, though not conclusive, evidence for considering that these flows might be even of post-Cretaceous age.

This paper was discussed by Professors A. W. Grabau, A. W. G. Wilson, A. C. Lane and A. F. Foerste.

Then was read:

Reconnaissance in Arizona and Western New Mexico along the Santa Fé Railroad: N. H. Darton, Washington, D. C.

The reconnaissance was made for the purpose of ascertaining the prospects for deep wells to supply water to the railroad and settlements along its line. The region examined was from ten to forty miles wide and in this area the principal structural and stratigraphic features of formations from Cambrian to Cretaceous were determined.

This was followed by the reading of:

Geologic Studies in the Alaska Peninsula: Wallace W. Atwood. (Introduced by A. H. Brooks.)

Detailed work was done in the vicinity of Chignik, Balboa and Herendeen bays and on the Island of Unga. The Balboa-Herendeen Bay district was selected as a type area in the peninsula, and detailed studies were pursued in the hope of working out a key to the general geologic conditions of this portion of Alaska.

The formations exposed include the Upper Jurassic, Lower and Upper Cretaceous, marine and freshwater Eocene, Miocene, possibly some Pliocene, Pleistocene and recent Kenai plants were found associated with marine invertebrate shells of Upper Eocene age.

Vast quantities of igneous rocks have been intruded into the sedimentary series, and overlying a portion of the area there are volcanic tuffs and basic flows of post-Miocene age.

Coal occurs in the Upper Cretaceous and Eocene. Gold and copper prospects were examined at several localities.

Then was presented:

Present Knowledge of the Oklahoma Red Beds: Charles N. Gould, Norman, Okla.

After this was read:

The Fauna of the Fern Glen Formation: Stuart Weller, Chicago, Ill.

The Fern Glen formation is typically developed in St. Louis and Jefferson counties, Missouri, and Monroe County, Illinois. It lies at the summit of the Kinderhook group and consists of beds of red calcareous shales and red limestones, with a maximum thickness of about forty feet. The upper beds are more greenish in color and merge gradually into the superjacent Burlington limestone. The fauna is distinctly a member of the southern group of Kinderhook faunas and consists for the most part of corals, crinoids and brachiopods, with a few blastoids, molluscs and trilobites. Many of the species are undescribed, although more or less closely related to known forms in other Kinderhook faunas or in the Burlington limestone. The correlation of the fauna is with those of the basal Knobstone shales of Kentucky, the St. Joe marble of Arkansas and the Lake Valley beds of New Mexico.

The paper was discussed by Professors Charles Schuchert, Stuart Weller and E. O. Ulrich.

The next two papers were read by title:

Age and Geologic Relations of the Sankaty Beds, Nantucket: W. O. Crosby, Boston, Mass.

Age and Relations of the Sankaty Beds: H. W. SHIMER, Boston, Mass. (Introduced by W. O. Crosby.)

Then the following paper was read:

Some Features of the Wisconsin Middle Devonic: H. F. CLELAND, Williamstown, Mass.

This paper gave the results of a study of all the outcrops, as far as known, of the Wisconsin Devonic and their contained faunas. In it were discussed: (1) the relation of the strata to those above and below, (2) the unconformities, (3) the lithological characters and (4) the character, relationships and geographical distribution of the faunas.

Professors Charles Schuchert, A. W. Grabau and H. M. Ami participated in the discussion of this paper.

The next paper read was:

Ice-borne Bowlder Deposits in mid-Carboniferous Marine Shales: JOSEPH A. TAFF, Washington, D. C.

Great numbers of bowlders and other erratic fragmental rock débris occur in the Caney formation of the Ouachita Mountain region in southeastern Oklahoma. The erratic material consists of bowlders, cobbles and small rock fragments of three general classes, namely: (1) limestones, siliceous, argillaceous and magnesian; (2) flints, cherts and (3) quartzites.

The limestones are of various textures and colors, some of which partake of the nature of the quartzites, while others are argillaceous; others yet appear to be dolomitic or perhaps dolomites. Many of the limestone bowlders are massive and homogeneous, while others are distinctly stratified and contain two or more classes of limestone, or strata of limestone and flint.

Flint and chert bowlders are also of common occurrence, and in places are even more abundant than the limestone bowlders. Certain of these flints are stratified or bedded and are black or bluish in color, while others are massive, chalcedonic in character and contain inclusions of drusy quartz. Among these are many of conglomerate and brecciated nature.

The third group in the general classification of these erratics includes quartzites of dark and reddish hues.

These erratic bowlders vary in size from small pebbles to bowlders of enormous size, a few of which attain lengths of more than fifty feet. Many of the smaller bowlders are more or less rounded, while a few are quite perfectly so. The larger ones are, as a rule, angular.

At three separate localities in the Ouachita Mountain region certain of the limestone and flint bowlders contain grooves and striæ as if produced by the action of shore ice. Certain of these striæ also resemble the markings of slickensided surfaces. The evidence as to the origin of these gouged surfaces is not conclusive.

The erratic bowlders contain a comparatively abundant Ordovician and Silurian fauna. The bowlders are promiscuously scattered in the Caney formation of black and blue shale with local beds of sandstone in the upper part.

The Caney formation is several hundred feet thick and contains limy concretions or segregations, associated with the erratic bowlders and elsewhere, that contain an abundant fauna of late Mississippian or early Pennsylvanian age.

The area of bowlder-bearing beds of the Caney formation, as now known, is within the Ouachita Mountain uplift in Oklahoma that extends within a few miles of the Arkansas line to the west end near Atoka.

The structure of the region is typically Appalachian, the rocks being closely folded and thrust northward.

Upon comparison, both lithologically and faunally, the erratic bowlders are found to contain identical characteristics in the Cambro-Ordovician and Silurian rocks in the Ouachita Mountain region of Oklahoma and in the Cambro-Ordovician section in north-central Texas. There are evidences of emergence of the rocks of mid-Carboniferous time in the western part of the Arbuckle uplift and in the Texas region to the southwest that affect the Cambro-Ordovician and Silurian rocks. The tentative conclusion is that the bowlders were transported from a land to the south by the agencies of ice.

This paper was discussed by Messrs. David White, W. C. Alden and J. A. Taff.

The last paper on the sectional program was:

Relationships of the Pennsylvanian and Permian Faunas of Kansas and their Correlation with Similar Faunas of the Urals: J. W. BEEDE, Bloomington, Ind.

Owing to physical changes which occurred during the close of Pennsylvanian time, there occurred a great reduction of Pennsylvanian species, followed by the introduction of Permian species. This introduction of new species becomes very noticeable in the Elmdale formation and its base is considered the base of the Kansas Permian. The Permian, as here understood, includes the

Artinskian and "Permo-Carboniferous" of Eurasia.

REPORTS OF COMMITTEES

Through Mr. Arthur Keith the Committee on Geologic Nomenclature reported that it had organized by the election of Professor T. C. Chamberlin as chairman and Mr. A. Keith as secretary. The committee is constituted as follows:

For the Geological Society of America: Professors T. C. Chamberlin and W. B. Scott.

For the U. S. Geological Survey. Mr. Arthur Keith and Dr. David White.

For the Association of State Geologists: Dr. J. M. Clarke and Professor E. A. Smith.

For Canada—Geological Survey: Professor F. D. Adams. Other official surveys: Dr. W. G. Miller.

For Mexico: Dr. J. G. Aguilera and Dr. C. Burckhardt.

The Photograph Committee, Mr. N. H. Darton, reported that there had been few accessions during the year and practically no use of the collection.

On account of the length of the program the council formed a special section for the consideration of certain papers forming part of a symposium on correlation which had been arranged for by Mr. Bailey Willis, chairman, and Dr. F. P. Gulliver, secretary, of Section E (Geology and Geography) of the American Association for the Advancement of Science. For the sake of record the whole list of these papers, with the times when they were read, follows.

MONDAY, DECEMBER 28

Before Section E. (By title in G. S. A. program.)

Pre-Cambrian

11:00 A.M. to 12:10 P.M.

C. R. Van Hise: "Principles of Pre-Cambrian Correlation."

F. D. Adams: "The Basis of Pre-Cambrian Correlation."

Early and Middle Paleozoic

3:30 to 4:00 P.M.

C. D. Walcott: "Evolution of Early Paleozoic Faunas in Relation to their Environment."

4:00 to 5:50 P.M.

A. W. Grabau: "Physical and Faunal Evolution of North America in the Late Ordovicic, Siluric and Devonic Time."

4:50 to 5:30 P.M.

Stuart Weller: "Correlation of Middle and Upper Devonian and Mississippian Faunas of North America."

TUESDAY, DECEMBER 29

Before a temporary section of the G. S. A.

Late Paleozoic

11:00 A.M. to 12:05 P.M.

G. H. Girty: "Physical and Faunal Changes of Pennsylvanian and Permian in North America."

David White: "The Upper Paleozoic Floras, their Succession and Range."

Vertebrates

2:00 to 3:15 P.M.

S. W. Williston: "Environmental Relations of the Early Vertebrates."

H. F. Osborn: "Environment and Relations of the Cænozoic Mammalia."

Mesozoic and Tertiary

3:15 to 4:00 P.M.

T. W. Stanton: "Succession and Distribution of Later Mesozoic Invertebrate Faunas."

4:00 to 5:15 P.M.

W. H. Dall: "Conditions Governing the Evolution and Distribution of Tertiary Faunas."

Ralph Arnold: "Environment of the Tertiary Faunas of the Pacific Coast."

WEDNESDAY, DECEMBER 30

Before a temporary section of the G. S. A.

Tertiary and Quaternary

10:50 to 11:25 A.M.

F. H. Knowlton: "Succession and Range of Mesozoic and Tertiary Floras."

11:25 A.M. to 12:25 P.M.

R. D. Salisbury: "Physical Geography of the Pleistocene with Special Reference to Conditions Bearing on Correlation."

D. T. MacDougal: "Origination of Self-generating Matter and the Influence of Aridity upon its Evolutionary Development."

2:30 to 3:45 P.M.

T. C. Chamberlin: "Diastrophism as the Ultimate Basis of Correlation."

After the reading of scientific papers had been finished, the society met again in general session and Professor J. M. Clarke proposed a vote of thanks to the citizens of Baltimore, the authorities of the Johns Hopkins University and in particular to the members of the department of geology for the welcome accorded to the society and the particularly complete arrangements made for the work of the meeting and the comfort and enjoyment of those in attendance. The vote was

most heartily passed and was responded to by Professor W. B. Clark in behalf of the Baltimoreans concerned.

The society adjourned shortly before 5:00 P.M., on Thursday, December 31.

The following officers were elected by the society for the year 1909:

President—Grove K. Gilbert, Washington, D. C.

First Vice-President—Frank D. Adams, Montreal, Canada.

Second Vice-President—John M. Clarke, Albany, N. Y.

Secretary—Edmund Otis Hovey, New York City.

Treasurer—William Bullock Clark, Baltimore, Md.

Editor—Joseph Stanley-Brown, Cold Spring Harbor, N. Y.

Librarian—H. P. Cushing, Cleveland, Ohio.

Councilors (1909–1911)—George Otis Smith, Washington, D. C., and Henry S. Washington, Locust, N. J.

The following were elected as fellows of the society: Elliot Blackwelder, Madison, Wis.; William Phipps Blake, Tucson, Ariz.; Charles Wilson Brown, Providence, R. I.; Frank Carney, Granville, Ohio; Edward Salisbury Dana, New Haven, Conn.; Cassius Asa Fisher, Washington, D. C.; Albert Johannsen, Washington, D. C.; Geo. Frederick Kay, Iowa City, Iowa; Henry Landes, Seattle, Wash.; George Burr Richardson, Washington, D. C.; Joaquim Candido da Costa Sena, Ouro Preto, Minas, Brazil; Earle Sloan, Charleston, S. C.; George Willis Stose, Washington, D. C.; Charles Kephart Swartz, Baltimore, Md.

One hundred thirty-five fellows were in attendance, making this second Baltimore meeting the largest in the history of the society. The council voted to hold the next winter meeting in Boston and Cambridge.

EDMUND OTIS HOVEY,
Secretary

SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 455th meeting was held February 20, 1909, with President Palmer in the chair. Dr. M. W. Lyon, Jr., exhibited the skins of two weasels from the vicinity of Washington, D. C. One was taken in the middle of the relatively mild winter of 1906–7 and showed the light brown pelage of long fur, characteristic of the winter pelage of weasels in this latitude. The other was taken in the latter part of March, 1904, and was mainly in the white winter pelage characteristic of weasels in higher latitudes. The middle line of the back showed the dark brown shorter summer pelage coming in. The winter of 1903–4 was colder than that of 1906–7. Whether that had anything to do with causing a white pelage instead of a light brown one could not be said.

The following communications were presented:

Some Japanese Entomologists and their Laboratories, with Notes on the Introduction of Parasites of the Gypsy Moth: L. O. HOWARD.

Dr. Howard spoke of some Japanese entomologists and their laboratories, and of the recent work in importing parasites of the gypsy moth and the brown-tail moth. He described some of the recent innovations in the large-scale experiment which has been carried on for three years by the Bureau of Entomology of the U. S. Department of Agriculture in the importation of parasites from Europe and from Japan, most of which have been mentioned in the annual report of the Chief of the Bureau of Entomology for 1908. He spoke especially of a trip to Japan taken during the summer of 1908 by Professor Trevor Kincaid, of the University of Washington (Seattle), as an agent of the bureau, to collect and send to the United States the Japanese parasites of the gypsy moth. This expedition was highly successful, and Mr. Kincaid met with the most gracious courtesy and the most hearty cooperation on the part of the Japanese entomologists. The talk was illustrated by lantern slides showing groups of Japanese entomologists at different agricultural colleges and experiment stations, as well as at private stations, and also of the experiment station buildings and laboratories.

Some Remarkable Phenomena Occurring in the Breeding of Varieties of Dianthus: J. B. NORTON.

Since 1904 several hundred seedling carnations have been grown each year by Mr. E. M. Byrnes, of the Bureau of Plant Industry, in the greenhouses of the Department of Agriculture. From the notes and records kept of these seedlings by the speaker, it was found that about 23 per cent. of the seedlings were typical single flowered, the remainder being double. The double flowers could be divided into two groups—standard doubles, *i. e.*, like the parent varieties, and full doubles, or "bull-heads"; the latter class averaging about 25 per cent. of the total number of seedlings. The close agreement of these percentages was that of a second generation of a Mendelian hybrid, which led to the prediction that the commercial carnation was a hybrid type and that the single and bull-head types were the extracted pure parent

forms. Experiments were carried on to determine this point by crossing single-flowered plants with the pollen of the full doubles. Out of three hundred seedlings in 1906 from crosses of this kind only two singles were found, the remainder being standard, or hybrid doubles. These two singles could have been from accidental pollination with pollen from other singles, since the flowers were not covered. Singles crossed with singles gave nothing but single-flowered seedlings. The full doubles failed to set seed on account of their defective ovaries, which were often changed into collections of petal-like organs. This work has since been repeated by other breeders with perfect results under control conditions. The double flowers are interesting in that doubling is accomplished in the same flower by increase in the number of whorls of petals, by change of stamens into petals, and by basal branching of large petals into a number of smaller ones. These three methods seem to be associated as one character. In the intermediate hybrid the three methods of doubling all appear, but in reduced form.

For many generations the parents of the American carnation varieties have been uniformly of the hybrid type, but as yet we have no instance of it reproducing true to type by seed, the two parent types constantly reappearing in about their normal proportions. Other characters, such as dwarf habit, short calyx, clove scent, color, variegated petals, etc., seem to follow the same law of heredity. Since *Dianthus caryophyllus* is normally strongly proterandrous and carnation breeders in the past have uniformly practised wide cross breeding, so that, if anything, the vigor of the type is constantly increasing, it is interesting to note the occurrence of Mendelism in this group, as recent unsupported theories have claimed that such should not be the case.

M. C. Marsh,
Recording Secretary

THE TORREY BOTANICAL CLUB

The meeting of February 24 was held at the Museum of the New York Botanical Garden at 3:30 P.M. In the absence of the president and both vice-presidents, Mr. Fred J. Seaver was called to the chair.

The following scientific program was presented:

Collecting Fungi in Jamaica: Dr. W. A. Murrill.

This paper has been published in the February *Journal of the New York Botanical Garden.*

Cypripedium in the Light of its Segregates: Mr. G. V. Nash.

Mr. Nash exhibited living plants and herbarium specimens illustrating the four segregates now recognized by orchidologists, and formally considered as parts of the genus *Cypripedium.* These segregates are *Cypripedium, Selenipedium, Paphiopedilum* and *Phragmipedium.* These divide themselves into two groups. In the first group are *Cypripedium* and *Selenipedium,* characterized by the usually long, leafy stem and broad, flat, thin, many-nerved leaves which are convolute in venation, and the withering perianth persistent on the ovary. In *Cypripedium* the ovary is one-celled, and the seeds elongate with a thin testa. This genus is of north temperate distribution, its representatives, about thirty in number, being found in North America, Europe and Asia.

The other genus of this group, *Selenipedium,* has a three-celled ovary, and the seeds nearly globose with a crustaceous testa. This is found from Panama to northern South America and is rare. It contains only three species, which are seldom seen in cultivation.

The second group is at once recognized by the conduplicate venation of its long, narrow, fleshy, strap-shaped leaves and the deciduous perianth. The flowers are borne on scapes, which are rarely somewhat leafy below. To this group belong the remaining two genera, *Paphiopedilum* and *Phragmipedium.* In the former the ovary is one-celled and the sepals imbricate in the bud. The most evident character, however, differentiating this at once from *Phragmipedium,* is in the lip which has the margin of the opening straight, not infolded. The scape is also commonly one-flowered, the exception being with more than one. There are some fifty species known in this genus, which is entirely old world, being generally distributed in tropical Asia and the Malay region.

The genus *Phragmipedium* is entirely new world, occurring in northern South America and Panama. It contains in the neighborhood of a dozen species, and is at once separated from *Paphiopedilum* by the character of the lip in which the margin of the opening is marked by a broad infolded portion. In addition to this the ovary is three-celled and the sepals valvate in the bud; the scape, moreover, bears several, sometimes many, flowers.

We have then in the new world three of the genera, two—*Phragmipedium* and *Selenipedium*—not known elsewhere, and *Cypripedium,* which it shares in distribution with the old world. The only strictly old world genus is *Paphiopedilum.*

Percy Wilson,
Secretary